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A STUDY OF THE INSTRUCTIONAL GESTALT IN UNIVERSITY COURSES PRESENTED BY TELEVISION.

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THE USEFULNESS OF A MULTIVARIATE PARADIGM FOR RESEARCH IN HIGHER EDUCATION WAS EXPLORED IN THIS INVESTIGATION. THE INSTRUCTIONAL PROCESS WAS CONCEPTUALIZED AS FOUR CLUSTERS OF INTERACTING VARIABLES--LEARNER, ENVIRONMENTAL, INSTRUCTOR, AND COURSE VARIABLES. THESE VARIABLES ARE DESIGNATED AS THE 'INSTRUCTIONAL GESTALT.' FOR METHODOLOGICAL REASONS, THE RESEARCH WAS CONDUCTED IN FIVE TELEVISED COURSES. 'CRITICAL SUBJECTS' POSSESSING THE DESIRED COMBINATIONS OF LEARNER CHARACTERISTICS WERE IDENTIFIED IN EACH COURSE AND ASSIGNED TO EXPERIMENTAL GROUPS COMPRISING A FULL SET OF CRITICAL SUBJECTS (ALL COMBINATIONS OF LEARNER VARIABLES). THESE SETS WERE RANDOMLY ASSIGNED TO RECEIVING ROOMS PRESENTING VARIOUS CONFIGURATIONS OF INSTRUCTOR AND ENVIRONMENTAL VARIABLES. THREE CRITERIA OF PERFORMANCE WERE USED--TWO WERE END-OF-COURSE ACQUISITION MEASURES AND A THIRD WAS A MEASURE OF 'THOUGHT RELEVANCE.' THE DESIGN IN EACH COURSE GENERATED AN ANALYSIS OF VARIANCE MATRIX FOR EACH OF THE CRITERIA. THE PARADIGM WAS DISCUSSED AS A USEFUL STRATEGY FOR RESEARCH IN THAT IT HELPS TO CLARIFY CERTAIN DYNAMICS OF THE EDUCATIONAL PROCESS WHICH ARE ORDINARILY OBSCURED. ORGANIZING CONCEPTS WERE PRESENTED TO INTEGRATE THE RESULTS, AND STUDY IMPLICATIONS WERE MADE. (JC)

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The Instructional Gestalt in Televised University Courses

Laurence Siegel and Lila C. Siegel
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A Study of the Instructional Gestalt in University Courses Presented by Television

Laurence Siegel and Lila Corkland Siegel

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PART I. INTRODUCTION

Chapter 1. Background for the Study

Chapter 2. A Generalized Multivariate Paradigm for Instructional Research

This Report is written at three levels. It summarizes an investigation into certain factors maximizing the efficiency of formal instructional settings. At this level, we present findings with implications for practice in higher education. At a more basic level, the Report discusses the study as a test of the power of our underlying conceptualization of the instructional process and of a research methodology suggested by this conceptualization. At the third, and still more fundamental level, we have attempted to formulate generalizations about teaching and learning on the basis of the conceptual framework and the data generated from it. We regard it as premature to build a theoretical structure upon these generalizations because they are post hoc extrapolations from our data. Assuming verification by subsequent research, these generalizations could assume the character of theoretical propositions.

The underlying conceptual framework is the heart of the entire enterprise. It provided the rationale for the investigation, helped delimit the specific variables to be considered, and restricted the empirical methodology. We have chosen to designate this a framework of the "instructional gestalt" in order to convey something of the flavor of our underlying views about the instructional context.

The first of these views is that to have the greatest power and utility, a conceptualization of the instructional configuration must recognize the large number and diversity of variables comprising it. Rather than beginning with a single variable, or a small number of variables, we chose to conceptualize the instructional whole: i.e., the gestalt. In encouraging explorations of the instructional gestalt, we are encouraging simultaneous examination of the entire fabric rather than successive analyses of its color, texture, pattern, and fibres.

Secondly, we mean this designation to imply recognition of the complex interactive relationships between instructional variables. Univariate analyses, and studies restricted to main effects, neglect and obscure these interactions. In contrast, the instructional gestalt cannot be examined without analyzing these interactions.

Because of these views about the most fruitful approach to instructional research, we were led to formulate a paradigm embodying multivariate analysis and techniques for identifying interactions. This paradigm is discussed in Chapter 2. Its presentation is preceded in Chapter 1 by examining some of the alternative paradigms which we found deficient and constructing the case for the particular analysis of variance paradigm we employed.

CHAPTER 1

BACKGROUND FOR THE STUDY

In recent years, higher education has become a subject of psychological research and thinking in a new and exciting way. The reasons for the resurgence of professional attention to educational problems by representatives of allied disciplines are diverse. They include such factors as international competition for technological superiority; enrollment pressures generated in a democratic society with a high standard of living; financial assistance for research on education from funds, foundations, and the federal government; improvements in social scientific methodologies appropriate to educational investigations; and the inclinations of social scientists to help shape the development of a significant social institution.

Even before the recent revival of interest by allied disciplines, however, the voluminous literature considering educational problems both philosophically and empirically amply documents the tremendous amount of activity in this field. The recently published *Handbook of Research on Teaching* (Gage, 1963) was an heroic attempt to bring order to much of this literature. At least two things are impressive when the massive body of educational research is considered in toto. First, as Ericksen observed in his review of the *Handbook* (1964), and as so many other authors have also observed, educational studies are relatively long on empiricism and relatively short on theory. Secondly, the yield from educational studies seems to be relatively low; non-significant differences are reported with monotonous regularity. Although both of these assessments have been widely made, it is appropriate to consider each of them in some detail as background for our own study.

Theories of Instruction

There is an obvious relationship between the cluster of behaviors designated "learning" and the cluster of behaviors designated "teaching." Yet whereas the relatively young science of psychology has generated several stimulating theories of learning, the long history of educational research has failed to be similarly productive in formulating theories of teaching.

In making this assertion, we are stating two things, each of which we will wish to examine separately.

First, the language as it pertains to educational theory is rather loose. With an enthusiasm for generalizing beyond the narrow limits of empirical restrictions, the distinctions between theories, models, and paradigms concerning education are sometimes indefinite. Although paradigms and models may ultimately lead to theoretical formulations, they are not theories themselves.

Secondly, and related to the first statement, the relative paucity of theory about teaching reflects the complexity of the instructional gestalt. Theories developed in related disciplines, like sociology and psychology, are relevant to specific aspects of the gestalt. Obviously it is helpful, in understanding education, to apply theoretical explanations of dyadic social relationships, learning, and so on. However an integrated theory about the complex behaviors involved in formal education cannot be assembled merely by summing the subtheories relevant to selected portions of the gestalt.

The Utility of Paradigms and Models

A paradigm is a general statement of presumed relationships between variables. As such, it aids research by restricting the investigator's attention to the specific variables embodied in the paradigm, and directing him to study any temporal, spatial, or other internal relationship specified by it. Thus a paradigm is a master plan for research. It provides no explanatory concepts, although it focuses research efforts by providing a context for investigation (Gage, 1963). Ultimately, of course, data accumulated in conformance with the paradigm's pattern need to be integrated and explained.

A model is merely one of the aids for integrating data. Literally speaking, a model is an isomorphic representation of a larger and more complicated aspect of reality. Thus a model airplane is smaller than the real thing. Because of its reduced size, a youngster can better comprehend it than he can a real airplane. He can examine it and perceive the relationships between its surfaces. The extent to which such a model will contribute to his understanding of how the real airplane works depends upon the fidelity of the miniaturization both with respect to appearance and principle of operation.

The procedure where some known aspect of the real world is reduced to a model can be reversed. It is possible, in the absence of knowledge about the real world, to construct a hypothetical model of what this world or some object in it might be like. Then by testing the model to see if it "works," we better understand that aspect of the world it is supposed to represent. This is precisely what is done, for example, when a computer is programmed to represent a possible aspect of neural functioning or a set of decision-making processes. The computer program is a model of the real world presently unknown to us. The efficiency of machine operation based upon this program is a test of the representativeness or fidelity of the model, and hence of our level of understanding from which the model was generated. Thus, as Maccia (1962) indicates, representational models of real events or objects enable us to evaluate the theory from which the model was generated, but do not themselves generate new theory.

Another form of model is the model for as opposed to the model of something. In this case we attempt to generalize from an area about which we know a good deal to an area about which we know relatively little. The former serves as a model for the latter. Common elements are identified in the known and speculative areas, and the laws relating these elements in the more familiar area are applied in the area of speculation. Models based upon the well-defined body of knowledge about mechanical systems are cases in point. This knowledge about mechanical inputs, controls, and outputs and the relationships between them has provided a number of models for teaching-learning systems.

The usefulness of models for unfamiliar areas based upon knowledge in some other area depends upon the commonality of concepts in the two areas and the correspondence between the laws relating these concepts. Thus we cannot infer anything of value about transmission of neural impulses by modeling this after our knowledge of the flow of water in connecting pipes.

Mathematical models can be viewed as a special case of models for (i.e., non-representational) something. Mathematical models posit a mathematical relationship as the model for a non-mathematical structure. This is the case, for example, when a statement of mathematical probabilities is applied as a model for human decision-making behavior.

Note that models do not intrinsically explain anything. They allow us to integrate disparate observations by suggesting hypotheses about the relationships between variables. Only when these hypotheses are empirically verified, do we have laws with both explanatory and predictive power.

Theory from Related Disciplines

The instructional gestalt can be viewed from several perspectives. It is possible to perceive it through the eyes of the learner. In so doing, the objective of teaching is to effect certain behavioral changes in students designated "learning." A theory of teaching thus becomes simply a variation of a theory of learning. Depending upon the theoretician's predilections, he may capitalize upon reinforcement theory (e.g., Kendler, 1961), cognitive learning theory (e.g., Ausubel, 1963), and so on.

Equally valid is an emphasis like Smith's (1960) upon the teacher's operations. This emphasis questions the assumption that effective teaching necessarily produces effective learning. Some students learn in spite of "bad" teaching; others fail to learn in spite of "good" teaching. The amount and quality of learning are, according to this argument, neither the sole nor necessarily the most important criteria of teaching effectiveness. From this perspective, a theory of teaching could be derived from theories of communication or psychotherapy, to name just two.

Although in examining this situation, Gage (1963) restricts his attention to the limitations of teaching theories modeled after learning theories, his logic can be applied to the broader spectrum of potential underpinnings for instructional theory. Theories of instruction are inherently linked with the substantial body of discovery and generalization concerning learning, motivation, social behavior, communication, and so on. However we share Gage's conviction that theories of instruction must develop alongside of, rather than solely by inference from, theories in these more limited related areas.

The Low Empirical Yield

The fact that the formulation of instructional theory has lagged so far behind theoretical formulations in many areas with more limited empirical histories is eloquent testimony to the relative sterility of much of the research upon teaching. This relatively low yield can be largely understood in terms of methodological and criterion inadequacies.

Methodological Inadequacies

In their excellent discussion of designs for research on teaching, Campbell and Stanley (1963) discuss 12 factors jeopardizing the validity of various experimental designs. The first eight of these are relevant to "internal validity": i.e., they may produce uncontrolled effects confounding the effect of the independent variable(s). These include (a) events aside from the independent variable transpiring between the pre- and post-treatment measurement; (b) maturation as an intervening event; (c) the effects of pretesting upon posttests of the independent variable; (d) changes in instrument calibration, observers, scorers, etc.; (e) statistical regression when groups have been selected on the basis of their extreme scores; (f) biases resulting from differential assignment of subjects to experimental and control groups; (g) differential loss of subjects from the compared groups; (h) effects produced by unnoticed or unspecified interactions and erroneously attributed to the manipulated independent variable.

The four remaining factors discussed by Campbell and Stanley may act to restrict the generalizability of empirical findings. These factors include the well-known "Hawthorne effect," and various interactions between multiple experimental treatments, between selection biases and the independent variable, and between pretesting procedures and the independent variable.

Instead of retracing this ground already adequately covered, we will comment further on a particular source of low empirical yield especially relevant to our own research paradigm: the frequent reliance in educational research upon control group comparisons, wherein educational variables are too grossly specified.

The fundamental objective of the "instructional comparisons strategy" is to compare some innovation in instructional procedure with older, better established, more traditional or "conventional" procedures for attaining the same objectives. It is generally discovered that students learn about as much when exposed to one kind of instructional environment as they do from another. Such failures to refute the null hypothesis are often accompanied by a statement to the effect that the "Hawthorne effect" may have been responsible for the experimental group's behavior.

This research pattern is by no means the only one used. However there can be no quarrel with the fact that it continues to be reported with great frequency. Even recent concerted efforts to explore the effectiveness of electronic classroom aids have heavily favored the method of instructional comparisons (e.g., Carpenter and Greenhill, 1958; Siegel, Macomber and Adams, 1959; Macomber and Siegel, 1960).

Assuming subjects are properly selected for assignment to the groups, this classical method of investigation has obvious application to a wide variety of problems. Yet in its application to educational problems, investigators too often make erroneous implicit assumptions of homogeneity and independence of empirical conditions. This deficiency builds into the research design the likelihood of producing rather pedestrian findings.

The necessity for these assumptions is self-evident. In order to make comparisons between two or more instructional procedures, each of these procedures must be sufficiently independent of the others and homogeneous within itself to permit its utilization as an independent variable. However it is apparent that these assumptions often are untenable, even when the usual experimental controls are exerted (Hoveland, Lumsdaine, and Sheffield, 1949; Lumsdaine, 1953; 1960; 1963).

Of the two design requirements, independence and homogeneity, the former is the more easily satisfied in instructional research. Nevertheless it must be recognized that attempts to establish independent learning environments as experimental and control conditions may fail because teachers do not always share the investigator's zeal for purity of design. Teachers who discover visual devices or other modes of presentation enhancing the quality of their teaching under "experimental" conditions are justifiably eager to use them also in their "control" sections.

The requirement of homogeneity is both more difficult to satisfy and perhaps more frequently overlooked in instructional research. Homogeneity within each of the instructional procedures undergoing comparison must be assumed in order to generalize beyond the specific samples in the investigation.

Usually instructional procedures are superficially designated as "lecture," "televised," "independent study," "conventional," etc., and are treated as if they were uniform independent variables. However such uniformity obviously does not exist. "Conventional" classroom environments differ from one another, for example, with respect to the number of students enrolled, amount and type of verbal interaction permitted or facilitated by the instructor, the "psychological atmosphere" generated during the class period, etc., as well as in such obvious physical characteristics as room layout and hour at which the class is scheduled. Therefore to designate a class as "conventional," and to use this group as a control for comparative purposes, is to rely upon a very gross kind of descriptive designation. This criticism holds also for the gross designations applied to the various kinds of "experimental" procedures compared with the control.

A low level of information yield must be anticipated because the gross nature of the conditions under investigation probably produces cancellation effects in group data. Instead of dealing with samples exposed to homogeneous and independent conditions, the comparisons involve samples exposed to treatments each of which is relatively heterogeneous. Thus by collating data across samples for any treatment grossly designated as a particular kind of instructional environment, we may actually come close to approximating the distribution of data for the population of instructional treatments within each of the groups being compared!

Criterion Inadequacies

Even if we were to assume a valid methodology appropriate to instructional research, it is evident that criterion inadequacies alone would often predestine a low empirical yield.

Gage (1963) has distinguished between "criteria of effectiveness" and "process" paradigms for research on teaching. The former are basically representations of the relationships between criteria of teacher effectiveness and factors presumed to be correlated with these criteria. The latter focus upon the teaching process as an interpersonal relationship worthy of study in its own right.

Instructional comparisons invariably are based upon the "criteria of effectiveness" paradigm. The referrent for "effectiveness" may be either the teacher's or the student's behavior; the assessments may be objective or subjective; the criteria may include measures of achievement, judgments, or test performances (Domas and Tiedeman, 1950). In the final analysis, student achievement is generally regarded as standing in a superordinate position to all other criteria of effectiveness (American Educational Research Association, 1952).

As a practical matter, the criterion of student achievement is most typically derived from course examination scores. This criterion is sometimes defended on the ground that since it satisfies the instructor as a basis of assigning grades, it reflects attainment of educational objectives to the satisfaction of researchers. However, this defense is a weak one indeed. The process whereby an instructor is brought to the point where he is able to specify his objectives in terms amenable to evaluation is an extremely laborious one (Bloom, 1956). It is unlikely that studies of relatively brief duration afford sufficient contact between instructor and researcher to permit specification and assessment of higher level cognitive processes as dependent variables. Evaluative data in the affective domain are even more generally neglected, particularly when course examinations provide criterion data.

Somewhat less generally recognized or made explicit is the fact that even those course examinations measuring pertinent objectives are not well suited to serve as dependent variables for educational research. Student performance on these measures reflects the operation of many variables most of which are not controlled by the experimental design. Students, after all, operate under conditions of constraint compelling satisfactory examination performance not only in response to adequate instruction, but often in spite of inadequate instruction. They are sensitive and responsive to external pressures from parents, friends, graduation requirements, and so on.

Finally, examination performance provides a delayed criterion for assessing instructional impact, and hence is subject to considerable contamination. Certain students who never attend class and therefore never experience the independent variable under consideration, may perform extremely well on course examinations by virtue of having access to comprehensive notes taken by a person who has attended class meetings. In such instances the examination score reflects such variables as academic ability and motivation as well as the quality of notes taken by the one who attended class. The score may reveal what has been learned, but not necessarily what has been learned as a function of the instructional procedure under investigation.

The Case for a Multivariate Paradigm

If it is true, as we believe, that the development of instructional theories has been impeded by the prevalent pattern of data collection described above, the solution is to alter the way in which instructional research is conducted and the kinds of questions toward which it is directed. The time is long overdue when investigators stop inquiring whether one mode of presentation is as good as another, and undertake instead investigations of those conditions thought to optimize the realization of educational objectives under clearly specified and delimited conditions (Siegel, 1960; Deese, 1961).

To do this requires increased precision in conceptualizing the purposes of education, and the settings (or learning environments) that may be provided to accomplish these purposes. Although proportionately in the minority, several studies specifically focusing upon alternative procedures rather than existing products have been reported in the literature. Investigations of the relative effectiveness of presenting one versus both sides of an issue, and of the advantage of audience participation (Hoveland, Lumsdaine, and Sheffield, 1949) are noteworthy examples of this more precise and fertile approach.

The Purposes of Education

From a practical standpoint, disagreement about the relative importance of objectives in the cognitive and affective domains have significant implications for structuring learning environments. On the one hand, there is the traditional view of the classroom as an environment for transmitting knowledge. This is in sharp contrast with the view, reflecting a psychotherapeutic bias, that cognitive accomplishments without affective involvement are of little or no significance for behavior (Rogers, 1961; 1965). The former position suggests that the learner is a manipulatable object to whom something is done by the teacher and his resources. The latter stresses the importance of "independent discovery" and leads to a view of teaching and learning wherein teacher and learner reverse roles frequently and comfortably. The distinction from the learner's point of view is between "being taught to" as opposed to "participation and involvement in."

As a rule, individual courses within a curriculum generally strike some sort of middle ground between these extremes. Large lecture (or televised) courses may tend more to be information-dispensing in nature; seminar courses at an advanced level may tend more to encourage student involvement and participation. But even lecture courses vitally involve some students under some circumstances; and certain students under some circumstances remain personally uninvolved even in seminar classes.

Learning Environments

The observation that students are differentially involved even when exposed to an apparently uniform instructional environment calls attention again to the heterogeneity within such grossly designated conditions as "lecture," "seminar," "conventional," etc., classes. These designations are predicated primarily upon certain aspects of the physical environment in which the course is conducted, neglecting variations within each condition. Furthermore, gross comparisons between environments so designated tend to neglect factors aside from the classroom environment that also bear upon teaching and learning.

Neither the criterion of effectiveness nor the process paradigms are intrinsically suited to overcoming the lack of homogeneity within each of the conditions investigated. Furthermore both kinds of paradigm tend to oversimplify the reality of classroom instruction in a fashion that may seriously interfere with the validity and generalizability of the resultant findings.

What is required instead is a paradigm sufficiently broad in concept to embrace the full multiplicity and patterning of factors entering into the teaching-learning configuration. This paradigm must include, but not be limited to, the variables comprising the classroom environment. In addition it must allow for the likelihood that the factors comprising the instructional gestalt interact differently in different kinds of classroom environments.

Multivariate Analysis in Instructional Research

The two distinguishing features, multivariate analysis and provision for studying interactions between variables, suggested for such a paradigm have been discussed or implied by several other authors. Hoveland, Lumsdaine and Sheffield (1949) argue for multivariate experimentation with particular reference to media research. They distinguished between "population," "film," and "external" variables and hypothesized that the impact of a single variable within any of these classes might be contingent upon the accompanying variables. In an even broader context Tiedeman and Cogan (1958), and Stanley (1960) have cautioned against ignoring or only superficially considering the effects of possible interactions between instructional variables.

It is precisely these kinds of interactions that we suspect are partly responsible for producing cancellation effects in mean performance comparisons between grossly described classroom groups. Thus in the next chapter we attempt to conceptualize the formal educational process in a broad framework giving appropriate recognition to the variety of instructional settings, teaching procedures, simultaneously exposed learners, and multiple criteria of effectiveness without sacrificing either the essential flavor of the instructional process or specificity of its conditions.

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CHAPTER 2

A GENERALIZED MULTIVARIATE PARADIGM FOR INSTRUCTIONAL RESEARCH

Because of the comprehensiveness of the instructional gestalt which we attempt to conceptualize in a general fashion in this chapter, it is advisable at the outset to specify the limits of our own investigatory concerns.

All of our thinking, research, and speculation presented in the remainder of this book is restricted to higher education. This fact imposed certain restrictions upon the particular variables considered in establishing our research design. Although we have made efforts to the contrary, our concern for higher, rather than elementary and secondary, education may also have affected the nature of the general paradigm from which our research design originated.

We have previously indicated something of our reasons for designating this framework as a paradigm for instructional research. The choice of the modifier "instructional" instead of such other possibilities as "educationsl," "classroom teaching," "classroom learning," or "teaching-learning" was deliberate. We sought, by this choice, to avoid placing an undue emphasis upon either the teacher and his operations or the learner and his operations.

We wished, in addition, explicitly to recognize that whereas the classroom or student-station is a site of teaching, it does not constitute the entire context for learning. Students arrive at this site with a history; their activities while there are but a small fragment of their ongoing daily regimen; and their concerns during each fragmented learning session reflect the interaction of this history with other aspects of the immediate real world both in and out of the classroom. Although some instructors behave as though they are providing students with the one valid educational experience they will ever have in their entire lifetimes, this is a uniquely biased perception. The instructor's intellectual commitment to an academic discipline is the culmination for him of many educational and personal experiences. Most undergraduate students are not yet ready to make such a commitment.

Independent Variables Comprising the Instructional Gestalt

We were guided by four fundamental considerations in identifying specific variables for inclusion in the paradigm:

1. Each variable might legitimately be expected to have some bearing upon at least one criterion of instructional effectiveness. This expectation might follow directly from previous research (e.g., academic ability has been clearly identified as an important independent variable). Alternatively, the expectation could be an inference from research about variables not previously explored in a comprehensive manner.

2. Each variable either had to be measurable or amenable to categorization and classification. Thus, the variables comprising the paradigm had to be defined with a certain amount of precision.

3. Each variable could be "manipulated" along some unidimensional continuum. Organismic variables are indirectly "manipulated" by identifying critical subjects from a subject pool on the basis of their test scores. This occurs, for example, when specific students are selected to receive certain kinds of instruction. Non-organismic variables, like features of the classroom environment or techniques of instructional presentation, may be directly manipulated and empirically controlled.

4. There is reason to believe that each variable underlies what takes place in the instructional gestalt in a "fundamental" or "causative" fashion. This is a highly subjective consideration, particularly when considering organismic variables. Because of the interrelationships between these, cause-effect relationships are exceedingly tenuous. Nevertheless without this requirement, the variables embodied in the paradigm would have proliferated to the detriment of the scheme's usefulness. Thus we somewhat arbitrarily decided that a variable like "instructor's neatness of appearance" was not sufficiently important materially to affect the instructional gestalt.

Variables comprising the instructional gestalt could have been classified in several different ways. In our initial attempt to make such a classification (Siegel, 1960) we developed a conceptual scheme based upon four major variable clusters: learning environments, instructors, learner, and courses. Subsequent revisions of the framework have retained these four clusters, although the constituency of each cluster has been modified somewhat (Siegel and Siegel, 1963; 1964).

Learning Environments

The learning environment is defined by the physical setting and characteristics of the classroom or other instructional surround, and by certain events transpiring in the physical environment. The generalized paradigm recognizes that classrooms constitute the primary, but not the sole, learning environment. Other kinds of environments include the library carrel (for independent study courses), the student station in a language or other auto-instructional laboratory, the room at home where an off-campus telecourse is taken for credit, and so on.

Some of the specific variables helping define the learning environment are (a) class size, (b) physical characteristics of the classroom, (c) the physical presence or absence of an "authority figure" maintaining discipline, taking attendance, etc., (d) the methods by and extent to which audio-visual devices of various kinds are utilized, and (e) the extent and level of participation by students in class activities.

It is readily apparent that gross classifications by environment, like "TV classes vs. conventional classes," provide for variations with respect to such variables. However, it is important to note that different sections of any course designated by the same gross environmental classification (e.g., "TV class") may really constitute different environments. A useful analogy here is that of siblings who experience different environments even though raised in the same home.

Instructor Variables

The teacher's behavior both in and out of class constitutes the strategies and tactics of teaching. Whereas learning environments describe the physical setting and structure provided for the course, the instructor variables describe the unique contribution made to a given learning environment by the teacher. The teacher's operations that have been selected as particularly pertinent to the general conceptual scheme for the instructional gestalt are described in the following paragraphs.

Manifest Objectives.--There is often a marked discrepancy between a teacher's verbalizations about his objectives and the objectives he manifests to the students. The teacher, for example, who maintains to the investigator that he is attempting to stimulate critical thinking but who tests and grades only for rote recall actually reinforces rote memorization in at least two ways. First, the test itself implies to the students that rote recall is the most important instructional objective. From the student's perspective, a test reflects in its sampling of test questions the importance attached by the teacher to the various aspects of the course content. Secondly, since tests are graded, students are rewarded for learning whatever content the test samples.

In addition to test content, a teacher manifests his instructional objectives by his behavior both in and out of the classroom. Such manifestations may be obvious and deliberate, as when the teacher announces to his class that it is not necessary to learn a particular point, or that understanding of some issue must be deferred until a future time when a factual base has been acquired, or that a question raised by a student is more properly the subject matter of some other course. Manifestations of instructional objectives may also be less obvious, and possibly not even deliberate as far as the teacher is concerned. A gesture, facial expression, reply that is overly brief or lengthy, and so on, may effectively cue students about the content deemed most important by the instructor.

Personal Contact.--Instructors differ considerably in the extent to which they are interested in students as persons and derive genuine satisfaction from developing personal relationships with them. Some teachers actively seek personal contact with students, occasionally extending their influence beyond the confines of the classroom. Their students are more likely than those of "avoidant" teachers to sense a rapport with the instructor and to feel that they are personally known to him. "Avoidant" teachers perceive their role as limited to dispensing information or conducting in-class discussion in a rather impersonal fashion. They may not even learn their students' names, and generally are rather unavailable to their students either in or out of class.

Intellectual Climate.--Provision, or lack of provision, for classroom participation by students has already been cited as one of the important variables in defining the learning environment. Assuming an environment arranged to encourage student participation, the instructor may use this structure to encourage "intellectually divergent" or "intellectually convergent" participation as poles on a continuum of intellectual climates.

The terms "divergent" and "convergent" are used by Guilford (1959) to describe cognitive behaviors. We have adapted them from this source to describe types of intellectual climates encouraging parallel cognitive behaviors.

In a "convergent" climate, students may ask questions closely related to the immediate situation (lecture presentation, laboratory task, demonstration, etc.) with some assurance that their questions will be answered. The thrust of a convergent climate for interaction is to aid the student's comprehension of whatever tasks or knowledges are germane to the immediate learning environment.

In an "intellectually divergent" climate, the student is reinforced for stating ideas and making intellectual discoveries. The instructor implementing this climate is not threatened by questions to which he does not have facile answers and which may be only tangentially related to his planned sequence for the class period. This kind of climate rewards such student behaviors as application, synthesis, perception of relationships, and creative problem solving.

Learner Variables

The students exposed to any combination of learning environment and instructor variables are heterogeneous with respect to a large number of cognitive and non-cognitive characteristics. The ones selected as particularly pertinent to our paradigm are the following:

a) A constellation of characteristics variously designated as intelligence, academic ability, scholastic aptitude, etc.

b) Knowledge about the subject matter prior to enrollment in a course. Such prior knowledge may have been obtained from courses previously taken or from readings of a general nature.

c) Motivation with respect to the particular course content. Why is the student taking the course? What significance does it have for his personal or vocational objectives?

d) The student's set toward education. The extreme poles on the continuum of set may involve, on the one hand, a predisposition to accumulate isolated or specific facts and, on the other, a predisposition to attempt generalization by learning fact-clusters, developing concepts, and discovering principles.

e) Creativity in organizing his perceptual field and in solving problems.

Course Variables

Certain kinds of courses lend themselves more readily than others to particular kinds of structures (learning environments) and instructor behaviors. This is true because courses differ in the kinds of students attracted to them, the kinds of instructors desirous of teaching them, and the demands of the subject matter.

Hence at least three features of the course are important to the paradigm:

a) The subject matter area
b) The level of presentation (elementary or advanced)
c) Whether the course is required of or elected by the students.

Interactions Among Independent Variables

In the foregoing paragraphs we have provided a basis for comprehensive thought about the process of teaching and learning by identifying four clusters of independent variables and specifying certain critical variables within each cluster. Once the instructional gestalt is conceptualized in this fashion, the importance of interactions between the independent variables is immediately apparent. These interactions occur both between the variables within a given cluster and between variables across the four clusters.

By way of a simple illustration, consider the learner variable "academic ability." The powerful main effects of this variable have been repeatedly demonstrated in scholastic settings: other things being equal, bright students tend to learn more than less capable students. However, at least for certain criteria, academic ability has been shown to interact with another learner variable: creativity (Getzels and Jackson, 1962). It is likely also that this ability x creativity interaction is further elaborated, under some circumstances, by such other learner characteristics as motivation, set, and preliminary knowledge relative to the task under consideration.

In addition to these interactions between organismic variables, academic ability undoubtedly interacts with selected environmental, instructor and course variables. Whereas specific aspects of the instructional gestalt may stimulate bright students, these same elements may threaten or discourage students who are not so bright. Other aspects of the instructional gestalt that are encouraging to low ability students may cause brighter students to lose interest or "coast."

As a generalization, the effects of various kinds of instruction within a given course can be conceptualized and empirically studied in relation to variations in learning environments, learner characteristics, and the relevant activities of the instructor. The burden of investigation proceeding from this view is to discover combinations of learner, instructor, environmental, and course variables optimizing desired educational outcomes.

A schematic representation of the instructional gestalt conceptualized in this fashion for any course is shown in Figure 2-1. All variables are represented in this figure as dichotomous both to simplify the drawing and to facilitate relating the general paradigm to our particular research design. It is apparent from this figure that the conceptual framework focuses on the interactive relationships between variables comprising the instructional gestalt as well as upon the summary or main effects.

Criteria

In Chapter 1 we commented upon our perceptions of some of the major criterion inadequacies in instructional research. The conceptual framework heretofore described does not in any way limit the range of potential dependent variables. The impact of particular configurations within the instructional gestalt can be assessed by both "effectiveness" and "process" criteria. The criteria might be derived from measures of student acquisition or retention, teacher satisfaction, quality of thinking evoked by presentations, and so on. The particular criteria selected for study must follow from the prior delineation of limited course objectives and broader educational or curricular objectives. Different interactions within the gestalt are to be expected for the various criteria.

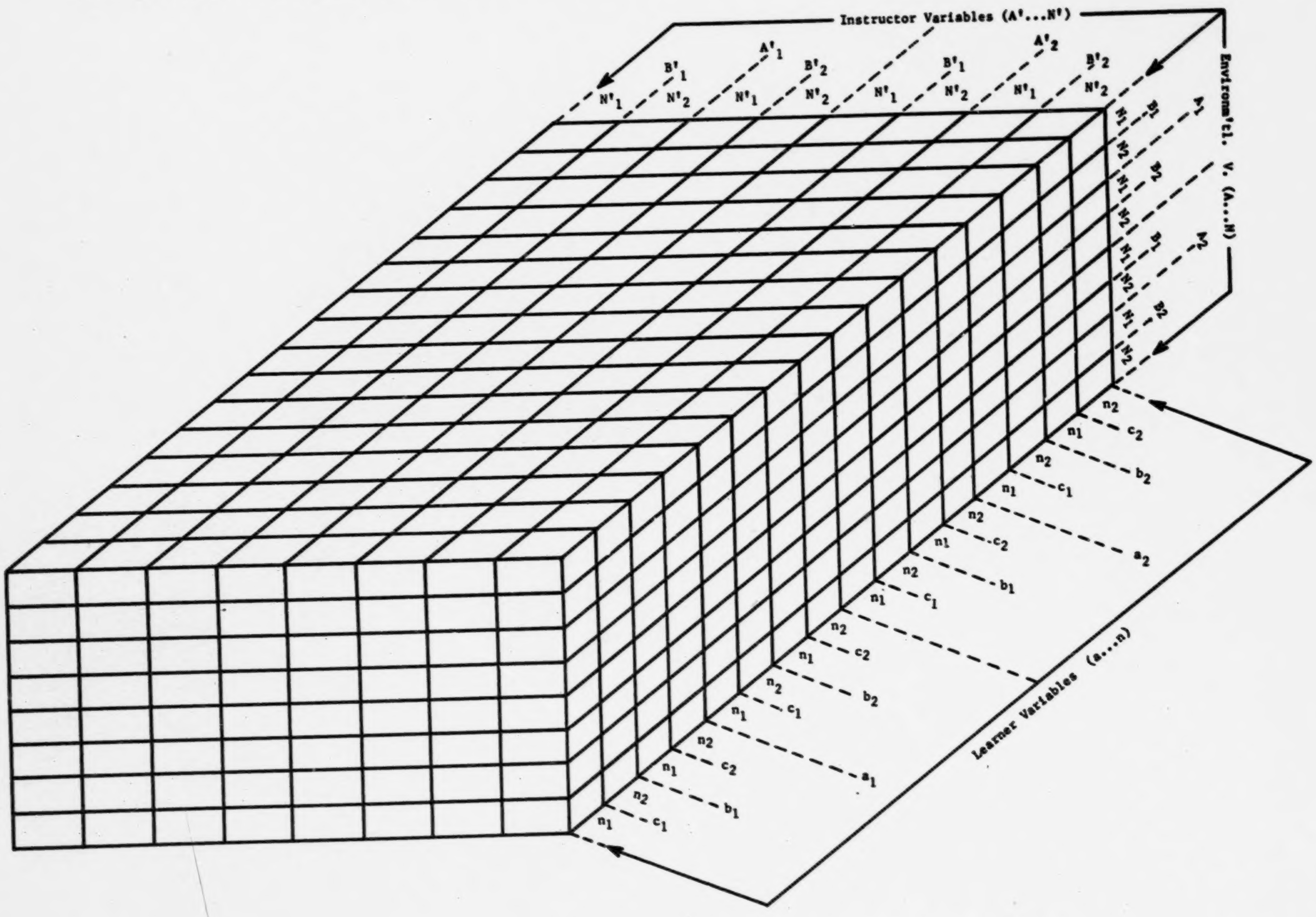
One of the ultimate goals of effective education is to maximize each student's capacity for thinking critically and creatively (Ericksen, 1962). To implement this broad curricular objective, Bruner (1961) emphasizes the importance of teaching about relationships (i.e., "structure") and Rogers (1961) similarly emphasizes a "problem" orientation. Both emphases are alike in that they maximize educational gain for the student by a process of independent discovery founded upon intrinsic involvement.

It is evident that some instructional configurations are more appropriate to this objective than others. It has been demonstrated, for example, that students think more relevantly in discussion classes than in lecture classes (Bloom, 1953). However, it is equally clear that practical exigencies often mitigate against utilizing the instructional configuration most appropriate to this objective. Hence it is important to discover the limits of effectiveness of alternative instructional configurations in terms of a fairly broad range of criteria.

Four classes of student-oriented criteria have been selected as meaningful dependent variables for exploring the instructional gestalt:

FIGURE 2-1

Schematic representation of the instructional gestalt for any course (DICHOTOMIZED VARIABLES)


Instructor Variables (A'...N')
A'1
A'2
B'1
B'2
B'1
B'2
N'1
N'2
N'1
N'2
N'1
N'2
N'1
N'2
Environm'tl. V. (A...N)
A1
A2
B1
B2
B1
B2
N1
N2
N1
N2
N1
N2
N1
N2
Learner Variables (a...n)
a1
a2
b1
b2
b1
b2
c1
c2
c1
c2
c1
c2
c1
c2
n1
n2

achievement, thought, attitude, and extra-class behavior. Although these criterion categories are not comprehensive, they provide a broad base for evaluating the effectiveness of instruction from the standpoint of student acquisition and retention.

Achievement

A hierarchy of potential achievements in the subject matter area has been thoroughly described in the well-known *Taxonomy of Educational Objectives: Cognitive Domain* edited by Bloom (1956). For initial explorations within the context of our paradigm, it seems sufficient to distinguish between two levels of achievement designated *factual* and *conceptual*.

Acquisition and Retention of Factual Information.--We have already argued against continued reliance upon assessments of factual acquisition and retention as a sole or even a major criterion for educational research. Nevertheless, it is evident that virtually all educational experiences attempt to convey or illustrate a body of factual content as at least a partial objective. Thus measures of factual acquisition and retention must be included in any attempt to list broadly applicable research criteria.

The importance placed upon this criterion must be proportional to the emphasis upon factual learning within the instructional gestalt under consideration. When factual learning occupies (or *should* occupy) a relatively low position in the hierarchy of educational objectives for a particular gestalt, it ought to occupy a correspondingly minor position in the hierarchy of criteria for assessing the effectiveness of variable combinations within that gestalt.

Acquisition and Retention of Concepts.--We use "conceptual learning" as a broad criterion classification embodying some of the higher levels of cognitive attainment outlined in the *Taxonomy of Educational Objectives*. This is really a criterion cluster which could, if desired, be differentiated into its more homogeneous and narrowly defined components. However, during the initial phases of exploration using the paradigm, we regarded it as sufficient to group together all cognitive attainments requiring more than mere factual acquisition. Thus we combine, for criterion purposes, those cognitive behaviors involving the application of facts to enable problem solution, and the interrelationship of previously discrete facts to form principles.

The key to our use of "conceptual learning" as a criterion is the cognitive operation performed by the learner. We can illustrate this with the developmental principle of progressive differentiation of animal behavior from mass to specific responses. Because of the treatment accorded this principle in the lectures and textbook, we might be compelled to classify knowledge of the principle merely as factual knowledge. This would be the case when the instructor or the text has stated this developmental principle in a way that would make it possible for a student to have learned it by rote.

In order to be classed as "conceptual" learning for criterion purposes, the student must be required by the criterion measure either (a) to construct the principle from the facts at his disposal without having previously encountered a statement of the principle per se, or (b) apply the principle, regardless of how it was acquired, to integrate or explain the relationship between what for him had previously been a set of disparate facts.

Thought

In Chapter 1 we criticized criteria based upon course examination performance even when these examinations adequately reflect the instructional objectives. These criticisms were based upon recognition of the contamination of examination performance by factors outside of the classroom.

Assessments of the quality of student thinking during the class period while the presentation is being made or the discussion is in progress overcome many of these criticisms. Such an assessment provides a unique criterion since it is obtained in situ rather than as a post-course measure. Reports of student thinking are systematically sampled at "critical points" in the presentation and are judged (i.e., "weighted") for relevance of thinking. The scoring continuum extends from irrelevant thinking at one extreme through passive attention and simple comprehension, to highly relevant thinking including attempts to apply information and synthesize.

The general procedure for assessing the quality of student thinking was suggested by Bloom (1953) and modified to permit group administration and objective scoring by Siegel, Siegel, Capretta, Jones, and Berkowitz (1963). The evolution of appropriate instrumentation is elaborated in Chapter 6.

Attitude

Criteria in the affective domain are less frequently utilized in cross-sectional educational research than those in the cognitive domain. This is so in spite of the fact that non-cognitive outcomes involving values and attitudes are usually highly placed in any ordering of educational objectives. In part, this results from the brief time span encompassed by most cross-sectional studies. Since the educational experience under investigation occupies a relatively brief segment of the total life span of the student, it may not be sufficiently powerful to produce significant non-cognitive change. Furthermore, these objectives are particularly difficult to specify in terms permitting evaluative instrumentation. The time and effort needed for such specification is more likely to be expended in longitudinal than in cross-sectional studies.

Practical considerations aside, a generalized paradigm must provide adequately for assessment by non-cognitive as well as cognitive criteria. We have limited our listing of critical non-cognitive dependent variables for exploring the instructional gestalt to two types of attitudinal measures: those related to a particular course or other instructional experience, and those pervading the entire curriculum.

Course-Related Attitudes.--It should be possible to delineate specific desired affective outcomes for almost every course or other limited educational experience. For example, we might anticipate that an elementary psychology course ought to encourage certain attitudes concerning the appropriateness of scientific method for the behavioral sciences, the sources of international tension, the status of psychology as a profession, and so on. If these are important instructional objectives, the gestalt for elementary psychology cannot be fully explored without using appropriate attitudinal measures as partial criteria of instructional effectiveness.

Curriculum-Related Attitudes.--Certain kinds of affective development or change may be anticipated as a result of the total curriculum rather than a single course. This development may involve changes in the students' self-perceptions or general approach to new or unfamiliar circumstances and problems.

Although this kind of development is most properly regarded as a pervasive curricular objective, it may be appropriate to define the "most effective" instructional gestalt for a given course as the one enabling that course to make a maximum contribution to the over-all curricular objectives.

Extra-Class Behavior

The question of the behavioral validity of attitudinal measures has been too frequently raised to merit repetition here. Even if we assume a correspondence between expressed attitude and behavior, there would still remain the important schism between situationally expressed attitudes and extra-situational behavior. Experiences in industrial training programs, for example, often lead to certain attitudinal changes within the context of the program which do not generalize to the working environment.

This circumstance is by no means limited to non-cognitive attainment. Elements of course content learned sufficiently well to meet the challenge of the final examination may subsequently be rapidly forgotten. And there is often a noteworthy discrepancy between the ability to state and apply principles on an examination and the ability to make applications in the world outside of the classroom.

Dissatisfaction with total reliance upon criteria of educational effectiveness obtained in the scholastic setting is expressed in many ways by all parties to the instructional endeavor. Parents, students, and teachers regard "life" as a broad practical test of the validity of educational experiences. The ways in which life provides this test are diverse. Some persons regard vocational "success" as the acid test; for others it is "self-realization" and "personal adjustment"; for still others it is continued "intellectual growth"; and so on. Each of these extra-class objectives can be specified and defined behaviorally. Once delineated, these behaviors provide yet another criterion of the effectiveness of the instructional gestalt for particular courses.

Values of the Paradigm

The conceptual framework for instructional research outlined in the preceding pages rests upon the conviction that factors comprising the instructional gestalt are likely to interact in ways which are obscured in a univariate analysis. The resultant research model represented in Figure 2-1 is the familiar analysis of variance matrix wherein each cell represents a unique combination of variables different from the combination represented by any other cell. The analysis of variance model itself generates certain methodological and statistical issues to which we will turn our attention in Chapter 3. However before doing so, we will pause briefly to review the paradigm and its intended applications.

The paradigm restricts our attention to four classes of independent variables: learner, instructor, environmental, and course. The specific variables within each of these classes which we believe to be the most potent determinants of what transpires within the instructional gestalt have also been specified. Finally, we have described alternative criteria for assessing instructional effectiveness and state our conviction that components of the gestalt probably interact somewhat differently for the different criteria.

It follows, then, that there can be no instructional panacea: i.e., no one best instructional method. The best method is conditioned by the educational objectives, the circumstances, and the participants. With reference to the latter, a particular combination of instructor and environmental circumstances may be more effective for stimulating attainment of a given objective for certain students than for others. Similarly, given a particular kind of student and certain defined instructor behaviors, particular learning environments are more conducive than others for encouraging attainment of a specific objective.

It is apparent that the investigator proceeding from such a paradigm asks different kinds of questions than he does when his research stems from other frameworks. Rather than inquiring whether one mode of instruction is as good (or better) than another, he inquires into the combination of variables maximizing the desired outcomes. Instead of establishing a relationship between independent and dependent variables, he seeks to describe circumstances defining the limits of strength and weakness in independent-dependent variable relationships. In short, the paradigm recognizes the importance of individual differences and assumes that whereas certain combinations of circumstances maximize goal attainment by some learners, these same combinations may be ineffective or even inhibiting to goal attainment by other learners.

Theoretical Implications

The paradigm provides leeway both for testing a priori hypotheses stemming from theoretical considerations and generating a posteriori hypotheses amenable to subsequent controlled exploration. In pursuing the former course, the investigator seeks to verify predictions about maximally effective combinations within the instructional gestalt. These predictions would have been evolved from theory in such areas as learning, motivation, and so on. In pursuing the latter course, the investigator systematically explores the matrix noting stable interactions. Hypotheses formulated post hoc can, if subsequently verified, either be integrated into existing theory or provide the base for a new theoretical formulation.

Our own research using the paradigm has been largely of the post hoc hypothesis-formulation type. We explored as much of the instructional gestalt as feasible with the resources available to us in order to identify meaningful interactions. These interactions were then interpreted by formulating generalizations. Each of these generalizations is broader than the particular interaction(s) taken as illustrative of it. They were suggested by our own empirical data sometimes interpreted in combination with empirical findings from other sources, and sometimes in combination with existing theory. Depending upon the amount of support available for each generalization from sources external to our study, some are more speculative than others.

Our purpose in constructing generalizations frankly "going beyond" the data is to suggest certain hypotheses appearing to us to be fruitful for subsequent investigation. The cause-effect relationships implied therein are, of course, inferred from rather than demonstrated by our data. To the extent these hypotheses are substantiated by controlled empirical test, they could be incorporated into a theory of instruction. But this ultimate goal far exceeds the purpose of the present work.

With respect to theory formulation it is our purpose in this book simply to illustrate one way in which theories of instruction can be derived, and to state some generalizations of the order that might ultimately become component principles of a theory of instruction.

Practical Implications

Theory aside, the research herein reported has generated a good deal of empirical data. These data have practical utility even though the causes of established relationships may not be known. At the most rudimentary level, this research identifies a number of interactions meriting further study. For certain of these interactions, subsequent investigation could profitably provide an empirical rather than a speculative base for understanding and explanation.

Assuming replicability of our findings, they have certain implications for managing effective instructional experiences. These experiences can be arranged in practice to provide those combinations of variables demonstrated to enhance desired outcomes. Conversely, those combinations demonstrated to inhibit the realization of desired outcomes can be avoided in structuring instructional experiences for students.

The conceptual framework for investigating the instructional gestalt is particularly fertile in this regard because of its focus upon specific variables instead of grossly described classroom procedures. It is thus equally applicable to decisions involving conventional classroom instruction, programmed instruction, instruction by means of the various media, and instruction using innovations not yet apparent.

Whether or not this pattern of investigation is sufficiently useful eventually to permit sectioning students in particular courses into instructional constellations maximizing the probability of successfully attaining course objectives by each of them remains to be seen. Certainly the mechanics of advising students into particular sections are relatively simple, provided it can be demonstrated that specific instructional arrangements optimize educational outcomes for particular kinds of students.

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PART II. RESEARCH DESIGN

Chapter 3. Overview of the Research Design

Chapter 4. Learner Variables: Instrumentation and Subjects

Chapter 5. Instructor and Environmental Conditions

Chapter 6. Dependent Variables

The four chapters in Part II give operational substance to the generalized multivariate paradigm by describing its application to our particular series of investigations.

In Chapter 3 we present an overview of our research design. This chapter summarizes our methodology and the factors that led us to use our particular analysis of variance model. In it we also discuss some of the statistical issues inherent in our use of an analysis of variance model.

Chapters 4-6 describe the specific ways in which we implemented our design. The instrumentation for selecting subjects with appropriate combinations of learner characteristics is discussed in Chapter 4. Chapter 5 describes the procedures whereby the instructor and environmental conditions were manipulated. Instrumentation for assessing criterion performance is described in Chapter 6.

CHAPTER 3

OVERVIEW OF THE RESEARCH DESIGN

Our purpose in this chapter is to make the transition from the generalized multivariate paradigm already described in Chapter 2 to the particular analysis of variance paradigm underlying our series of investigations. In making this transition we provide an overview of our procedures and discuss certain methodological and statistical issues generated by our use of an analysis of variance model.

The Analysis of Variance Model

The generalized multivariate paradigm exhibited in Figure 2-1 restricts the researcher's attention to four classes of independent variables: environmental, instructor, learner, and course. In the related discussion we identified (a) specific variables within each of these clusters which we believed to be the most potent determinants of what transpires within the instructional gestalt; (b) alternative criteria for assessing the effectiveness of combinations of these variables.

In commenting upon the generalized paradigm, one of our colleagues observed that its full exploration could require several lifetimes. The truth of this observation is evident when one considers that the paradigm is built upon 16 independent variables (5 environmental, 3 instructor, 5 learner, 3 course) each of which is presumed to interact with all others. The matrix for possible interaction is further elaborated because many of these variables are continuously distributed. Finally, the paradigm suggests the importance of assessing instructional outcomes by using multiple criteria because different interactions between independent variables are anticipated for the various instructional objectives.

In view of the wide range of research possibilities suggested by the generalized paradigm, certain critical decisions were required to effect a transition between it and a manageable research strategy. We will consider two decisions that were paramount in suggesting our particular analysis of variance model in some detail. These two decisions led us to limit the specific variables with which we would be subsequently concerned, and to dichotomize each of these variables. Although it is convenient to discuss these as separate issues, they really stemmed from the same basic concern: i.e., maximizing the empirical yield from a limited number of available courses and potential subjects.

The Research Variables

The generalized paradigm for exploring the instructional gestalt involves a complete factorial arrangement of 16 independent variables. Assuming that each of these variables could somehow be dichotomized, thereby reducing the number of experimental conditions to a minimum, this paradigm generates 65,536 different combinations of environmental -instructor-learner-course circumstances. Obviously, this number of conditions is unmanageable. Even with one subject per matrix cell, the available pool of subjects would have to number in the hundreds of thousands in order to provide the required number of "critical" subjects Furthermore, the extensiveness of empirical manipulations required to effect the necessary conditions is beyond the scope of a single investigation.

Therefore it was necessary to simplify the multivariate paradigm for research purposes by arranging circumstances so that some of the variables could be treated as constants.

Environmental Variables.--Our primary explorations of the instructional gestalt were conducted in televised courses. These courses were chosen as a starting place for research based upon the generalized paradigm for methodological reasons. In such courses it is possible simultaneously to transmit a lecture emanating from a single source to a number of different classrooms. Then by manipulating or otherwise arranging circumstances within each receiving room, it became feasible to explore various dimensions of the instructional gestalt under otherwise controlled conditions.

The advantages of this use of televised instruction in providing desired experimental controls over the learning environment are self -evident. Several receiving rooms simultaneously provide data for a given matrix. The physical characteristics of the several receiving rooms were essentially similar with respect to capacity (about 65 students) and physical arrangement. Students in all rooms received the identical presentation at the identical moment in time. Since these were televised courses, the enrollments tended to be rather large thereby providing us with a sizable pool of available subjects. In the advanced courses where enrollments were low in spite of the TV offering, replication of the course during subsequent semesters to permit the desired experimental manipulations was facilitated by replaying videotapes in successive years.

Since most of the research was conducted in televised courses, two environmental variables particularly germane to TV instruction were systematically manipulated: the presence or absence of an "authority figure" (proctor); and the extent and level of participation by students in classroom discussion.

The fact that the studies were, in the main, conducted in TV courses imposes certain limits upon the likely generality of our findings. It is not anticipated that findings derived from televised courses will necessarily be generalizable to the instructional gestalt in face-to-face settings. However it would be erroneous to regard our findings from these courses as applicable only to televised settings. In terms of the variables comprising the instructional gestalt, we regard the series of investigations conducted in TV courses as exploring those portions of the gestalt pertinent to lecture-type instruction in a relatively convergent instructional environment. This type of instruction and environment is not restricted to televised courses. It is provided by many instructors in face-to-face settings even with relatively small classes.

Course Variables.--The three course variables (subject matter area, level of presentation, and required or elected by students) were eliminated from the multivariate analyses by the simple expedient of developing separate matrices for each course. Although this strategy prevented us from accumulating empirical data pertinent to the interactions between these three variables and the others that were systematically explored, certain inferences about their impact were possible because of the spread of courses included in the main portions of the study. These courses are identified and briefly described in Figure 3-1. (Although limited studies were conducted in other courses not taught by television, a discussion of these is deferred until later in this report.)

Figure 3-1
Courses in Which Studies Were Conducted

Course Title	Level of Presentation	Required or Optional
Introductory Educational Psychology	Survey; primarily for freshmen and sophomores	Required of all enrollees (education majors)
Introductory Physiology	Survey; primarily for freshmen and sophomores	Required as one of the biological science alternatives for graduation
Introductory Zoology	Survey; primarily for freshmen and sophomores	Required as one of the biological science alternatives for graduation
Business Psychology	Advanced; primarily for sophomores and juniors	Optional for School of Business majors
Shakespeare	Advanced; primarily for juniors and seniors	Optional for advanced majors in the English Department

The three survey courses had been taught by television for several years prior to the inception of this study. Their annual enrollments ranged between approximately 300-600 students. A primary factor in selecting the two advanced courses included in the study was the willingness of these instructors to teach by television.

Instructor Variables.--The five courses providing the primary data for the sequence of investigations were each taught by a single instructor throughout the entire period of the research. Therefore we could also have elected to treat the instructor variables as constants following the procedure we employed with the course variables.

We rejected this alternative because of our *a priori* conviction that instructor variables are sufficiently critical to the instructional gestalt to merit their empirical exploration. The importance we attached to the instructor variables was congruent with both the lore of teaching and a sizable body of accumulated evidence that the teacher makes an important difference in the effectiveness of instruction. The two instructor variables explored in depth were "manifest objectives" and "personal contact."

As we will describe subsequently, it was possible to arrange classroom circumstances to manifest the desired objectives and provide the desired personal contact without imparting undue artificiality to the instructional gestalt under study. Since we felt that the third instructor variable, intellectual climate, could not be successfully manipulated it was treated as a constant for each matrix explored.

Learner Variables.--The five learner variables (academic ability, prior knowledge, motivation, educational set, and creativity) were systematically explored both as they generated main effects and as they interacted with each other and the other variables under consideration.

An essential difference between these organismic variables and the other research variables was that whereas the latter could be manipulated by arranging suitable instructional conditions, such manipulation was clearly impossible for the learner variables. Student characteristics are "givens" with which the students enter a course. In this regard they provide a different kind of independent variable from one like "instructor's manifest objective." We will discuss some of the implications of this difference between organismic and manipulated variables later in this chapter.

Dichotomizing the Variables

In the foregoing discussion we indicated that we limited our research to nine of the 16 variables specified by the generalized multivariate paradigm. Of these nine, five were learner variables, two were instructor variables, and two were environmental variables. Even this decision to limit the scope of the research before beginning the investigations would have left us with an unmanageable series of studies if further limitations had not been imposed.

The problem in dealing with the advanced courses is self-evident. With an enrollment of about 50 students each semester, even the expedient of replication across semesters using videotape provided us with a total subject pool of only about 200 cases. From this pool we had to select "critical" subjects on the basis of nested organismic variables and make assignments to appropriate receiving room conditions. Although less severe in the survey courses, because of their larger enrollments, a similar problem existed in these courses also. With an approximate annual enrollment of 300 students, a given course replicated on television in two successive years provided us with a pool of about 600 subjects.

A multivariate design drains a subject pool very rapidly. It is helpful to think of each of our nine research variables as being of one of two types: five of these were organismic variables, and four were instructor-environment conditions. Because of the requirements of a full factorial design, it was necessary to identify sets of "critical" subjects such that each set represented all possible combinations of the organismic variables, and to assign these sets randomly to all possible combinations of instructor-environment conditions.

Dichotomizing Organismic Variables.--The number of critical subjects comprising a set depends upon the number of levels (or conditions) identified for each of the learner variables. Since each of these variables is continuously distributed, arguments could be made for differentiating four or more levels for each one. Without belaboring a point, even cutting the continuous distributions for the organismic variables at their quartiles would have required that each set of critical subjects nested on five variables contain 1024 cases. Furthermore it would have been necessary to identify as many of these sets of 1024 critical cases as there were combinations of instructor-environment conditions. This obviously would have been impossible with a total course enrollment (even accumulating data across years) of well under 1000 students.

Therefore it was necessary to use two expedients.

First, not all variables were investigated in every course. The number of organismic variables utilized for any course was typically four; it was never fewer, and was five for only one small portion of the over-all investigation.

Secondly, all organismic variables were dichotomized even though they were continuously distributed. Students at or above the 70th percentile of a distribution were designated as "high" on that variable; those at or below the 30th percentile were designated as "low" on that variable.

Taken together, these procedures reduced the number of critical subjects required to fill a fully factorial set to manageable size. In studies using four organismic variables, each set of subjects contained 16 cases; with five organismic variables, each set contained 32 cases.

Partly because we excluded the middle 40 percent of each organismic variable distribution, not all students enrolled in a course were available as potential subjects. To be a potential subject, the student had to be classifiable as either "high" or "low" on all organismic variables.

A complete set of critical subjects (i.e., 16 for four organismic variables and 32 for five organismic variables) further strained the subject pool because each critical case had to represent a particular combination of high and low scores on the organismic variables under consideration. We typically found that only 20-25% of the students registered in a course could actually be used as experimental subjects.

Dichotomizing Instructor-Environment Variables.--Combinations of the instructor-environment variables provided the instructional conditions to which parallel sets of critical subjects were assigned. To reiterate, the instructor variables with which we were concerned were manifest objectives and personal contact; the environmental conditions were presence or absence of a proctor, and student participation in classroom discussion. The details of implementing variations in these conditions are deferred until Chapter 5. It is sufficient here to indicate that each of these variables was structured as shown in Figure 3-2.

Figure 3-2
Empirical Arrangement of Instructor-Environment Variables

Variable	Dichotomized Arrangements	
	Condition 1	Condition 2
Manifest Objective	Manifest Conceptual Objective	Manifest Factual Objective
Personal Contact between student and instructor	Contact encouraged and facilitated	No contact
Proctor	Receiving rooms proctored	Receiving rooms unproctored
Student Participation	Participation by students in class discussion	No provision for class discussion

Summary of the Analysis of Variance Model

Figure 3-3 shows a composite analysis of variance model representing the design of the entire series of investigations. The shaded cell of the matrix is occupied by a student characterized by low ability, low creativity, a factual set, low motivation and low prior knowledge of the subject matter. This student received instruction in a proctored receiving room where classroom discussion was encouraged, the instructor manifested a factual objective, and there was no opportunity for personal contact between student and instructor.

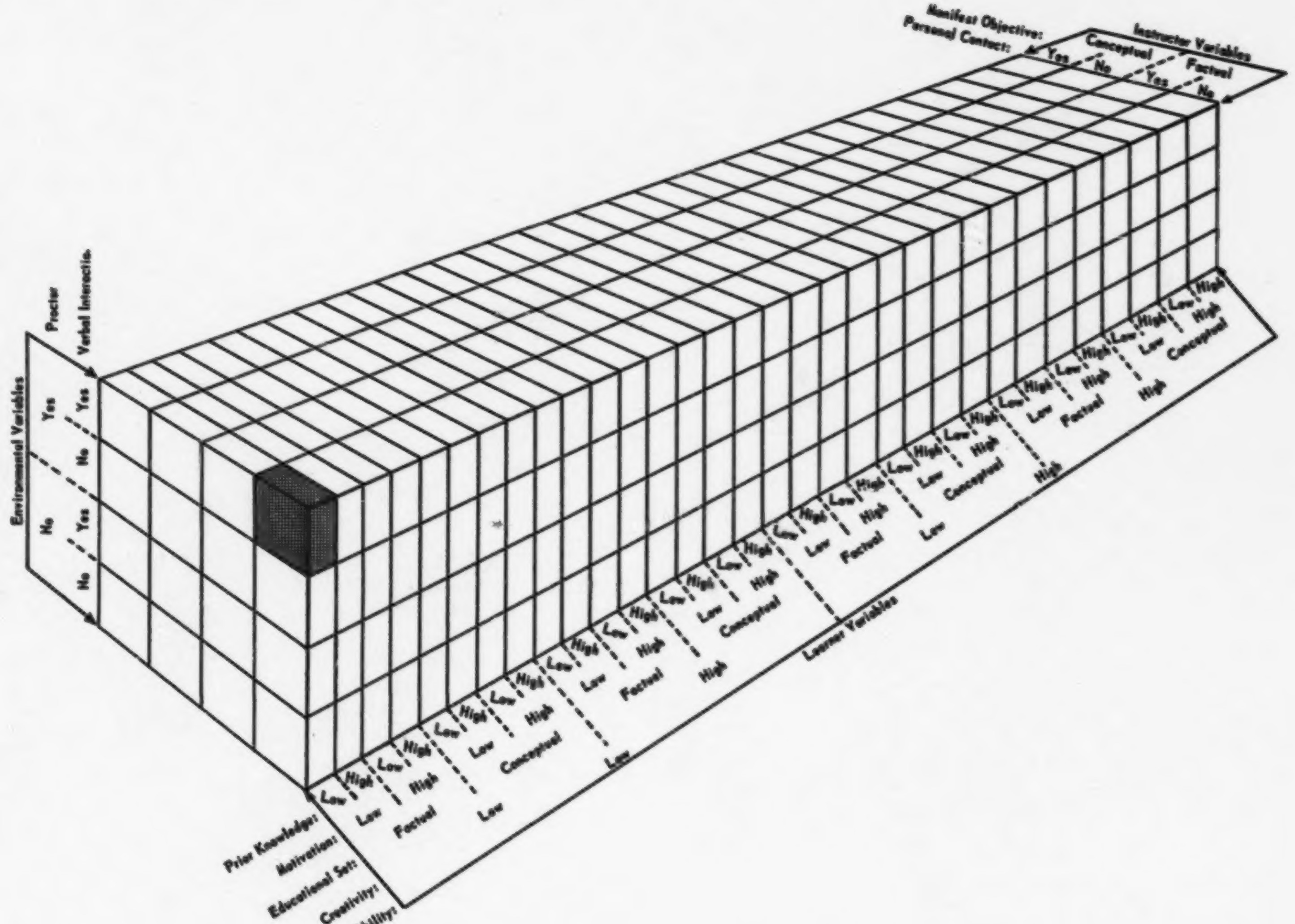
Manifest Objective:
Personal Contact:
Instructor Variables
Conceptual
Factual
Yes
No
Yes
No
Environmental Variables
Proctor
Verbal Interactio.
Yes
No
Yes
No
Yes
No
Prior Knowledge:
Motivation:
Educational Set:
Creativity:
Ability:
Low
High
Low
High
Factual
Conceptual
Low
High
Learner Variables

Figure 3-3 The Composite Analysis of Variance Model

Specific Designs

Figure 3-3 and the accompanying discussion elucidated the composite analysis of variance model used for this series of investigations. We have already indicated that not all variables were investigated in every course. Figure 3-4 shows the specific designs employed in the five televised courses providing the basic data for the investigation. For each of the designs, this figure shows

a. the variables explored
b. the size of the analysis of variance matrix
c. the number of sets of "critical subjects" required to effect the desired combinations of environmental and instructor conditions
d. the number of critical subjects in each set
e. the total number of critical subjects required (number of sets x number in each set)
f. the number of repetitions of the course required for full data collection
g. the total number of students enrolled in the course.

Design in Each Course

Figure 3-4 makes apparent subtle differences in the matrix of variables explored in each course. These differences are amplified in the following discussion.

Educational Psychology.--Although this was a two-semester course, data were accumulated only during the first semester of each academic year sequence. The lectures, examinations, and other course procedures were repeated for two successive years, providing a total pool of 683 available subjects. Critical subjects drawn from this pool were assigned to receiving rooms structured to effect three different experimental designs:

Design A explored seven variables (as noted in Figure 3-4) with two conditions for each and required 128 critical subjects. Creativity scores were not available for any of these subjects. Verbal interaction was not systematically manipulated.

Design B was a variation of Design A permitting investigation of the "verbal interaction" variable. This design utilized dichotomized conditions for four learner variables (creativity excluded) and two instructor variables. In addition it utilized a trichotomized arrangement for the environmental variables. The three environmental conditions were

1. no proctor and no verbal interaction
2. no proctor and verbal interaction
3. proctor and verbal interaction.

Figure 3-4
Designs in Televised Courses

	Course							
	Educational Psychology			Physiology	Zoology		Business Psychology	Shakespeare
	A	B	C		A	A^1		
Variables Systematically Investigated								
Learner Variables								
Ability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Creativity	No	No	Yes	No	No	No	No	No
Educational Set	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Motivation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior Knowledge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environmental Variables								
Proctor	Yes	Yes	No	Yes	Yes	Yes	No	No
Verbal Interaction	No		No	No	No	No	No	No
Instructor Variables								
Manifest Objective	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal Contact	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Analysis of Variance Matrix	2^7	$2^6 x 1^3$	2^7	2^7	2^7	2^7	2^6	2^6
Number of Sets of Critical Subjects	8	12	4	8	8	8	4	4
Number of Critical Subjects in Each Set	16	16	32	16	16	16	16	16
Number of Critical Subjects	128	192	128	128	128	128	64	64
Number Repetitions Required for Data Collection		Two		Two	One	One	Three	Four
Total Number Students Enrolled		683		817	551	492	173	168

Design C permitted investigation of creativity as a learner variable. In this design the two environmental variables were controlled rather than systematically manipulated. All critical subjects attended class in TV receiving rooms that were proctored and wherein classroom participation was encouraged.

Physiology.--This was another two-semester course wherein we accumulated data during the first semester only and repeated all course procedures over a two-year period. Although the pool of subjects was relatively large (817), we were unable to implement a design involving more than a 2^7 matrix. Hence creativity scores were not taken for these subjects, and classroom discussion was not permitted to occur in any of the receiving rooms.

Zoology.--The design for this course was identical to the one for Physiology with one notable exception. Because of the large annual enrollment in Zoology, it was possible to fill the entire 2^7 matrix during a single year, and to replicate the design in full during the second year. This is the only course wherein we obtained data for a full replication of the total design.

Business Psychology and Shakespeare.--These were both advanced courses, each one semester in duration, and each with a relatively low enrollment. The procedures were identical in the two courses: i.e., creativity scores were not taken, all receiving rooms were proctored, and classroom discussion following the TV lecture was not permitted. The three repetitions required for Business Psychology, and the four for Shakespeare were facilitated by replaying videotapes of the original presentations in successive semesters.

Receiving Room Arrangements

All students enrolled in each course were pretested during the first class meeting(s) to determine their placement on the continua for each learner variable. The discussion of the instrumentation for this purpose and of the way in which critical subjects were identified from the available pool is deferred until Chapter 4. It is sufficient here to indicate that subsequent to identifying critical subjects, these were assigned to receiving rooms along with the other students enrolled in the course. Since each receiving room was attended by about 60 students of which number only 16 (occasionally 32) were critical subjects, it is unlikely that anyone other than the investigators knew the identity of the subjects. As far as the students knew, they were all participating in a study of the instructional process. Furthermore, assignment of a given set of experimental subjects to a particular receiving room (i.e., instructor-environment combination) was randomly determined.

Figure 3-5 summarizes the receiving room arrangements established for each of the five televised courses in the study. By randomly assigning sets of critical subjects to appropriate receiving rooms, it was possible to develop the matrices for instructor-environment combinations called for by each of the designs specified in Figure 3-4.

Figure 3-5
Receiving Room Arrangements

Course	Year	Rec'g Room	Environment-Instructor Conditions				Number of Critical Ss	Number of Students
			Proctor	Verb.Int.	Mani.Obj.*	Personal Contact**		
Educational Psychology	1	1	No	Yes	C/F	No	32	72
		2	No	No	F	No	16	53
		3	No	No	C	No	16	52
		4	Yes	Yes	C/F	No	32	79
		5	No	No	C	No	--	59
		6	Yes	Yes	C/F	Yes	32	32
	2	1	Yes	Yes	C	No	16	69
		2	No	No	C/F	Yes	32	55
		3	Yes	Yes	C	No	16	55
		4	Yes	Yes	F	No	16	70
		5	Yes	Yes	F	No	16	55
		6	No	Yes	C/F	Yes	32	32
Physiology	1	1	Yes	No	F	No	16	83
		2	No	No	F	No	16	60
		3	No	No	C	No	16	58
		4	Yes	No	C	No	16	103
		5	Yes	No	C/F	Yes	32	32
		6	No	No	F	No	--	58
	2	1	No	No	C/F	Yes	32	50
		2	Yes	No	C	No	16	68
		3	Yes	No	C	No	16	62
		4	Yes	No	F	No	16	58
		5	Yes	No	F	No	16	130
		6	No	No	C	No	--	55

Figure 3-5 (Cont'd)

Course	Year	Rec'g Room	Environment-Instructor Conditions				Number of Critical Ss	Number of Students
			Proctor	Verb.Int.	Mani.Obj.*	Personal Contact**		
Zoology	1	1	Yes	No	F	Yes/No	32	78
		2	No	No	F	Yes/No	32	69
		3	No	No	F	No	--	45
		4	Yes	No	F	No	--	84
		5	No	No	F	No	--	21
		6	No	No	C	Yes/No	32	41
		7	Yes	No	C	Yes/No	32	41
		8	Yes	No	C	No	--	129
		9	No	No	C	No	--	43
Zoology	2	1	Yes	No	C	Yes/No	16	73
		2	No	No	C	Yes/No	16	76
		3	No	No	C	No	16	42
		4	Yes	No	C	No	16	79
		5	No	No	C	No	--	20
		6	Yes	No	F	No	16	20
		7	No	No	F	No/Yes	16	55
		8	Yes	No	F	Yes	16	87
		9	No	No	F	No	16	40
Business Psychology	1	1	Yes	No	F	No	16	38
		2	Yes	No	C	No	16	35
	2	1	Yes	No	F	Yes	16	45
	3	1	Yes	No	C	Yes	16	55
Shakespeare	1	1	Yes	No	C	No	16	42
	2	1	Yes	No	F	No	16	39
	3	1	Yes	No	F	Yes	16	54
	4	1	Yes	No	C	Yes	16	33

* F - manifest factual objective
C - manifest conceptual objective
C/F - manifest conceptual objective to half the group; manifest factual objective to other half.

** - No means that no provision was made for personal contact between students and the TV instructor. Yes means that provision for such contact was made. No/Yes means that selected students were provided with opportunities for personal contact whereas other students were not.

Statistical Designs

The designs for each of the courses generated one analysis of variance matrix for every criterion investigated. The cells of a given matrix were each entered with a single score. This was the score earned on a particular criterion measure by a particular subject possessing the required combination of learner characteristics and exposed to a particular combination of instructor-environment conditions.

The choice of an error term in an analysis of variance design with a single replication creates certain problems because of the absence of any estimate of experimental error corresponding to the mean square between treatments. One solution to this situation, discussed by Edwards (1960), is to combine the higher order interactions as an estimate of experimental error. In following this procedure for our 2^7 analyses of variance, we report error terms which are pooled mean squares of the five- and six-factor interactions.

Developing the error term in this fashion tends to underestimate statistical significance when some of the interactions contributing to the error term are themselves significant. In other words, if we had elected to consider as statistically significant only those mean squares at or below the .05 probability level, we would have run the risk of neglecting significant relationships.

The alternative, which we chose, was to liberalize our significant requirements to the .10 level. It is important to reiterate that because of our design, this level of probability implies statistical significance exceeding the .10 level to some unknown and varying degree depending upon the significance or lack of significance of the error term components. If none of these components are themselves significant, we have simply accepted a p level of .10. However if some of these components are significant, we are accepting a more stringent p level.

By using this statistical criterion, we run some danger of over-interpreting our data: i.e., attempting to interpret chance relationships. However this danger is minimized by restricting our attention to clearly significant findings ($p < .05$) and findings of borderline significance ($p < .10$ - $p < .05$) that consistently appear across courses.

Other Statistical and Methodological Considerations

Before describing the way in which the research design was implemented, it is appropriate to consider two related statistical -methodological issues. These issues, raised both by the general paradigm and by the specific analysis of variance model, concern

1. our use of potentially correlated organismic variables in a factorial design;
2. our use of dichotomized organismic variables and the consequent possibility of spurious interactions caused by differential regression.

Given our interest in the particular learner, instructor, and environmental variables upon which the paradigm is built, we could have elected a correlational rather than a factorial strategy. One such correlational approach, for example, would have generated a multiple correlation for each combination of instructor-environmental conditions. The learner variables would have been entered in these correlations as predictors of instructional outcomes.

Had we chosen this strategy, we would have circumvented the two issues we now must confront. Intercorrelations between the learner variables would have been reflected in the weights attached to these variables in the multivariate correlational analyses; and correlational analysis would have utilized the full range of organismic variable scores.

Appealing as a correlational strategy would have been for these reasons, it would have failed to reveal precisely those kinds of relationships we regarded *a priori* as most critical for understanding the instructional process. Whereas correlations would have revealed linear relationships, they may have obscured interactive relationships. Our view of the instructional gestalt posits the existence of important interactions both within each of the four variable clusters (instructor, environment, course, and learner) and between variables from each of these clusters. A simple illustration of the former kind of interaction would be a statement about the differential importance of motivation for, say, high and low ability students. An illustration of inter-cluster interaction would be a statement about the differential effectiveness of combinations of instructional conditions for certain kinds of students.

Given this objective, and the patently exploratory nature of this series of investigations, the factorial paradigm is clearly more promising than is a correlational paradigm. The factorial experiment is extremely powerful for discovering combinations of variables which appear to operate together, and levels of variables that operate differentially.

Although our design displays interactive relationships within the instructional gestalt, it does not of course, provide evidence for cause-effect linkages for these interactions. However since clarification of the *existence* of interactions is seen by us as a first hesitant step toward theorizing about instruction, it follows that our strategic choice had to favor a factorial over a correlational design.

Organismic Variables in a Factorial Design

Although as Edwards (1960) indicates, organismic variables may be meaningfully entered into factorial designs, this use of organismic variables is open to a certain amount of criticism. Such criticism rests upon the likelihood that all individual difference variables tend to be correlated in nature to some degree. Thus a group scoring high on a test of academic ability, for example, will tend to exhibit a somewhat uniform pattern of scores on other associated characteristics.

This fact generally has two important implications:

First, cause-effect inferences concerning organismic variables are tenuous because of the possible effect of some more basic underlying variable correlated with the ones investigated, but not itself selected for study. This implication is not, of course, restricted solely to factorial designs or, for that matter, solely to organismic variables. In any research there is always the risk that the factors investigated may merely be associated with the underlying causal conditions, and do not themselves operate causally.

A second implication is unique to factorial designs with organismic variables and therefore merits more careful consideration. To the extent that two or more organismic variables are correlated with each other, interactions between them may be spurious because these interactions are based upon a systematic rather than a random assignment to "treatment conditions." With reference to our design, this point is relevant only to interactions among the learner variables themselves. It is not germane to interactions involving one or more of these with at least one of the experimental treatments (instructor and environmental variables) because critical subject sets were randomly assigned to these treatment conditions.

The validity of interpretations of interactions between organismic variables themselves rests upon (a) the magnitude of the correlations between these variables and (b) reliabilities of the measures used for their assessment. The lower the intercorrelations (assuming high reliabilities), the safer the basis for interpretation.

Data on this point are displayed in Table 3-1 for the three televised survey courses. This table summarizes intercorrelations between the four learner variables we have most consistently used in our studies and the corrected split-half reliabilities of the measures. The intercorrelations were computed for samples of the full course enrollments (critical subjects and other students taking the course). On the basis of these data we were compelled to disregard all organismic variable interactions involving prior knowledge as a component. Probably because of the brevity of the prior knowledge tests (about 20 items each) the reliabilities of these instruments were low. However the relatively low intercorrelations between the three remaining measures combined with their relatively high reliabilities supported at least exploratory interest in any significant interactions between them.

Differential Regression

Earlier in this chapter we stated our reasons for electing to create just two conditions for each organismic variable: the "high" condition containing subjects scoring in the upper 30 per cent of the distribution; the "low" condition containing subjects scoring in the lower 30 per cent of the distribution. Even four levels or conditions for each organismic variable (i.e., cutting at quartiles) would have required as many sets of 1,024 critical subjects as there were instructor-environment conditions within each course. Obviously this would have been an unmanageable design.

Table 3-1

Intercorrelations Between Learner Variables and Reliabilities of the Instruments (Televised Survey Courses)

Course	Variable	Intercorrelations			Split-Test Reliability
		Ability	Motivation	Set	
Educational Psychology	Motivation	.11	X		.73
	Set	.27	-.04	X	.94
	Prior Knowledge	.32	-.06	.11	.43
Physiology	Motivation	-.16	X		.81
	Set	.23	-.06	X	.89
	Prior Knowledge	.25	.02	.03	.36
Zoology	Motivation	.02	X		.78
	Set	.29	.05	X	.85
	Prior Knowledge	.23	-.02	.04	.66
All Courses	Motivation	.03	X		.78
	Set	.27	-.02	X	.90
	Prior Knowledge	.27	-.02	.07	.50

By using only high and low groups for each organismic variable, we open the way for spurious interactions to occur by virtue of differential regression. To the extent that organismic variables are correlated, high-low groups will regress more on retest than either high-high or low-low groups. This differential regression occurs with correlated variables because there is greater capitalization upon chance in selecting high-low or low-high combinations than in selecting high-high or low-low combinations.

Referring again to Table 3-1, it is evident that this potential source of spurious interaction was probably not of major consequence except for those interactions involving prior knowledge as a component. However it is of some importance to note that because these interactions are based entirely upon extreme groups with the middle forty per cent of each score distribution excluded, we have no interaction data for learners in the mid-score ranges.

References

Edwards, A. L. Experimental Design in Psychological Research. N.Y.: Holt, Rinehart & Winston, 1960.

CHAPTER 4

LEARNER VARIABLES: INSTRUMENTATION AND SUBJECTS

This chapter and the one following are organized in terms of the distinction made earlier between two classes of independent variables: learner variables, and instructor-environment conditions. The former were inserted into the design by assessing all students enrolled in the course and selecting those with appropriate scores for inclusion as critical subjects. These procedures are described in this chapter. Chapter 5 discusses the methods for manipulating the instructor-environment conditions to provide the desired combinations of instructional circumstances.

The pretest battery administered during the initial class meeting consisted of three instruments especially developed for this series of investigations. These instruments, developed during the year preceeding initiation of the instructional gestalt studies, measured (a) educational set, (b) course-specific motivation, (c) prior knowledge of the subject matter. In addition, ACT composite score as a measure of academic ability was available for all students since this test is routinely administered to incoming freshmen. Finally, since one of the designs in Educational Psychology required an assessment of "creativity," certain of the scales developed by Guilford and his associates were administered to students in this one course.

Educational Set

The development of the Educational Set Scale (ESS) and some preliminary findings obtained with it has been reported by Siegel and Siegel (1965). Since this scale and its underlying rationale represents an interesting by-product of the research program, we will review its development in some detail.

There is ample evidence for broad cognitive "styles" in human behavior. Guilford's (1963) work on flexibility-rigidity, for example, has obvious implications for creative styles. The etiology of such broad behavioral sets involves the total past history of the organism. As determinants of adult behavior, they are "givens" predisposing particular kinds of cognitive responses. In Guilford's terms the organism is set to think rigidly or flexibly.

For the purposes of this research we postulated another broad kind of set with implications for teaching and learning--an educational set. This set is presumed to determine the specific kind of content the learner tends to extrapolate from the smorgasbord of his educational experiences. Educational set comprises a continuum defined at the poles of predispositions to learn factual content on the one hand and conceptual content on the other. Most persons are educationally set somewhere near the middle of this continuum, but at the extremes we hypothesized the existence of factually and conceptually set learners.

A factually set learner is one who, by definition, is predisposed to learn factual content. He adds units of information to his cognitive structure without being driven to interrelate these elements into any contextual whole. For such a learner, a fact has an integrity of its own.

A conceptually set learner is one who, by definition, rejects factual acquisition except as units of information are clustered and interrelated. He prefers to learn concepts and principles. When confronted by a bit of factual information, he either dismisses it as "unimportant" or subsumes it in a broader conceptual framework.

There are many intuitive reasons for believing that these polar sets exist and significantly influence educational behaviors. We speculated that educational set may affect student attitudes toward particular courses or topics within courses, particular teachers, instructional approaches, and examination formats. Therefore educational set was posited, a priori, as an extremely important learner variable within the instructional gestalt. Furthermore, educational sets may be partly responsible for curriculum elections and parallel vocational choices--criteria that were beyond the scope of this series of investigations.

Before the role of educational set could be investigated, appropriate instrumentation for measuring it and verifying its existence as an intervening variable in the instructional process had to be developed. We sought to develop a forced-choice, objectively scored, group inventory for assessing this variable.

A forced-choice format seemed, a priori, to be desirable for two reasons. First, we wished to reduce the possibility of verbalizing choices favoring conceptual over factual learning on purely superficial grounds. Without this control, respondents might be reluctant to admit a preference for learning factual content because it might make them "look less intelligent." Secondly, this format offered a convenient means of equating the perceived difficulties of paired factually and conceptually oriented alternatives. Without such equation, the conceptually oriented alternatives would generally have been more difficult to learn, thereby requiring more effort and ability than their factually oriented counterparts.

One triad with its scoring weights will serve to illustrate the desired format of the ESS:

> Items 70-72. Assume you are enrolled in a natural science course and must learn about the following. Which one will interest you most? Which one will interest you least?

Scoring			
Most	Least		
-1	+1	70.	The names of the elements in the "halide" group.
0	0	71.	Statement of Newton's Third Law of Motion.
+1	-1	72.	The significance of a pH of 6.

The over-all plan for developing the ESS consisted of four steps, each of which is separately described in this section: (a) preliminary item pool, (b) judgments, (c) item selection and item analysis, (d) standardization.

Preliminary Item Pool

Every item in the preliminary pool was a statement of content covered in a hypothetical undergraduate course. A deliberate attempt was made to include statements representing a wide range of difficulties in acquiring the specified content. Thus the preliminary items for a hypothetical geography course included learning Item 9, "The number of locks in the Panama Canal," and Item 11, "The latitude and longitude of the 50 most important cities in the world." Furthermore the preliminary pool contained statements of factually oriented content, like the two illustrations above, and conceptually oriented content like Item 23, "The factors responsible for westward migration in the United States."

The initial item pool consisted of 291 statements of content to be learned in six hypothetical courses distributed as follows: geography --75 items; social science--24 items; business and economics--42 items; government--62 items; natural science--60 items; and English--28 items. These particular hypothetical courses were used because college students generally are familiar with them. Although some statements were written by faculty members and undergraduate students, most were extrapolated from final examination questions administered in these courses.

Judgments

Weighting the Statements.--The first judgmental task was to classify each preliminary item as being factually oriented or conceptually oriented. This involved obtaining two sets of judgments: one from faculty members and one from students.

To secure faculty judgments, the statements describing the content of each hypothetical course were submitted to the appropriate departmental faculty with the request that each person independently judge every statement on the following continuum:

This knowledge involves

1. straightforward factual acquisition. It is the kind of information learned by rote and does not reveal any conceptualization to speak of.
2. primarily factual learning, although it reveals a minor amount of conceptualization.
3. a moderate degree of conceptualization.

4. a very high degree of conceptualization. The student who knows this is familiar with general principles and the interrelationships between them. This is not the kind of thing that can be memorized. It requires real understanding and integration of content.

In addition to these four categories, a fifth ? category was provided for items that "simply cannot be classified on a factual -conceptual continuum."

Since the number of faculty judges for each block of items was relatively small, no statistics were computed for these judgments. Instead these data were inspected to eliminate what faculty members considered to be grossly ambiguous items. Any item for which the faculty judgments were spread across more than two adjacent rating categories was eliminated from further consideration.

Our fundamental interest in weighting the items was, of course, to reflect undergraduate student perceptions about the placement of each item on the factual-conceptual continuum. Hence the entire set of preliminary items was administered to a sample of 100 subjects in a freshman -sophomore course with instructions to judge every statement using the 4-point continuum described above for securing faculty judgments. These student judges were randomly selected from a total course enrollment of about 500 students. (The remaining 400 students simultaneously provided us with judgments required for deriving preference indexes as described later.)

The resultant judgments were distributed on a continuum extending from 1.0 (straightforward factual learning) to 4.99 (a very high degree of conceptualization). The median summarized the central tendency; variability was summarized by $\underline{Q}$. Using these data we arbitrarily rejected from further consideration all items with $\underline{Q}$ values ($\underline{Q}_3$ - $\underline{Q}_1$) above 1.5.

Median data for the remaining items were held in abeyance while we considered judgments concerning preference values for each item.

Preference Values.--Since our objective was a forced-choice inventory controlling superficial response sets, it was necessary to develop blocks of items equated for preference value. Rather than use a single preference index, we elected to match items on four separate indexes: (a) perceptions about the level of academic ability required to learn the specified content, (b) perceptions about the impression created by virtue of knowing the specified content, (c) interest in learning the specified content, (d) personal relevance of knowing the specified content.

To compute these four indexes for each item, all 291 preliminary statements were given to four subgroups of about 100 students, each in the aforementioned freshman-sophomore course. Each judge rated every item on a 5-point graphic scale appropriate to the particular preference index under consideration by his subgroup.

Thus for every preliminary item we had five medians. One of these summarized judgments about placement of the item on a factual -conceptual continuum. The remaining four summarized judgments about the placement of the item on four continua, each representing a different aspect of possible superficial response sets.

Item Selection and Item Analysis

Items were selected and grouped into triads in two phases. First, triads were developed from the judgmental data. Second, the triads were verified and refined by preliminary administration and item analysis of the inventory.

Initial triad development proceeded as follows. Of the original 291 items, 204 were available for possible inclusion in triads. The items rejected at this early stage were eliminated either because the faculty judgments were spread over more than two adjacent rating categories or because the computed Q value for student judgments on the factual-conceptual continuum exceeded 1.5.

The surviving items were first sorted on the basis of median relevance judgments: i.e., judgments as to "how important it is to me to know this." Relevance clusters consisted of items falling within each .5 interval on the 5-point relevance continuum.

Items within each of these clusters were next sorted by median judgment on the factual-conceptual continuum. Any two items within a given relevance cluster and separated by more than 1.25 units on the factual-conceptual continuum were regarded as potential candidates for inclusion in a triad.

To this point we had identified item pairs wherein one alternative was more conceptually oriented than the other, and both alternatives had similar relevance ratings. The three remaining preference indexes were considered next. For a pair of items to be retained we required that the constituent statements not differ on any of these three median preference ratings by more than .30 scale units. Imposition of this requirement reduced the number of item pairs available for inclusion in potential triads to 69.

The remaining items were inspected to determine their suitability for combination with each pair to form a triad. Since these third members of each triad were ultimately to carry a zero weight for educational set, the requirements for joining them with an item pair were: (a) they must have medians for the four preference indexes within the range of medians for these indexes already established by the paired items; (b) their median placement on the factual-conceptual continuum must be approximately midway between the medians for the two items comprising the pair.

Using these requirements, we formed 46 preliminary triads. This number was further reduced by selecting the "best" four to six triads from each hypothetical course area. The best triads were the ones wherein the alternatives had (a) the most nearly equal preference values, (b) the greatest spread between the median factual-conceptual placement of the two weighted alternatives, and (c) a zero-weighted alternative most nearly placed on this continuum midway between the median placements of the weighted alternatives.

This selection resulted finally in 31 triads using 93 statements from the original pool of 291 items. Every triad was cast in the form:

> Assume you are enrolled in a (insert name) course and are required to learn each of the listed topics. Consider each set of three topics and rank them in terms of your interest. Assign a rank of 1 to the topic that would interest you most; a rank of 2 to the topic in which you would have intermediate interest; a rank of 3 to the topic that would interest you least.

The 31 triads were administered with these instructions to the total enrollment (N approximately 500) in Educational Psychology for the purpose of item analysis. (These data were collected in the year preceding explorations of the instructional gestalt.) A score was computed for each subject in the item analysis group using the scheme shown in Table 4-1. The effect of this scheme was to generate positive scores for conceptually oriented respondents and negative scores for factually oriented respondents.

Table 4-1
Scoring Scheme for ESS Triads

Kind of Alternative[a]	Rank by Respondent[b]	Weight
Factually oriented	1	-1
	2	0
	3	1
Neutral	1	0
	2	0
	3	0
Conceptually oriented	1	1
	2	0
	3	-1

[a] Determined by median placement on the factual-conceptual continuum.

[b] Ranks of 1 assigned to the "most interesting" and 3 to the "least interesting" of the three alternatives.

Using ESS total score as an internal criterion for item analysis, we identified high and low criterion groups of 100 cases each. The distributions of ranks assigned to each statement by the subjects in each criterion group were analyzed by the chi square to verify the initial triad constituency. Presumably, because of the extensive work in preliminary triad formulation, all triads survived this analysis in unaltered form. The factually and conceptually weighted items in each triad generated significant chi squares with opposing distributional trends. The neutral or distractor constituent of each triad yielded a statistically insignificant chi square indicating similarity in the distributions of ranks assigned to this alternative by the high and low criterion groups.

Standardization

The present form of the ESS contains 31 triads presented in a printed test booklet. It is geared to group administration using a standard IBM answer sheet and is readily scored by machine. No time limit is imposed for completion of the inventory; virtually all respondents finished within 20 minutes. The scale and scoring key are presented in Appendix A.

The validity of the ESS and the potential educational importance of the variable it purports to measure are discussed by Siegel and Siegel (1965) and in later chapters of this research report. Since we are here concerned only with the instrumentation itself, it is appropriate to describe certain other scale characteristics associated with standardization: reliability, concurrent validity, and norming.

Reliability.--Two estimates of reliability have been obtained for the ESS. The split-test(odd-even) reliability corrected for length in a sample of 487 respondents is .90.

An estimate of retest reliability was facilitated by the enrollment of 66 students in two of the courses included in the larger study of the instructional gestalt for which the ESS was developed. The correlation between test and retest for these subjects with time intervals ranging between 1 and 5 days was .92.

Correlations with Concurrent Measures.--It is evident from Table 4-2 that the function measured by the ESS is relatively independent of other cognitive functions assessed by the ACT Composite score and certain of the Guilford creativity tests.

Norming.--Our purpose in developing the ESS was to provide us with a research instrument facilitating identification of the most factually and conceptually set students in particular undergraduate courses. Table 4-3 summarizes the distribution characteristics of ESS scores. Note the instrument's sensitivity to class standing and divisional enrollment. Percentile conversions for raw scores computed separately for each course are attached as part of Appendix A.

Table 4-2
Correlations Between ESS and Other Concurrent Tests[a]

Test	ESS	ACT	Consequences		Alternate Uses
			Remote	Obvious	
ACT Composite	.22	X			
Consequences					
Remote	.09	.21	X		
Obvious	-.09	.02	.08	X	
Alternate Uses	.01	.21	.07	.11	X
Pertinent Questions	.05	.27	.09	.38	.17

[a] N = 222 freshman and sophomore students.

Table 4-3
Distribution Characteristics of the ESS

Course	N	Range	Median	Q_1	Q_3
Educational Psychology	337	-37 to 40	9.20	1.67	18.00
Physiology	357	-20 to 41	9.10	0.00	17.00
Zoology	504	-23 to 41	7.45	0.00	19.25
Business Psychology*	55	- 8 to 52	22.75	13.50	27.00
Shakespeare*	71	-19 to 50	20.30	12.50	32.33

* Upper division course.

Course-Specific Motivation

The purpose of the Motivation Scale was to permit assessment of students' initial attitudes toward the courses included in the study. The instrument used for this assessment was the Thurstone type of scale exhibited in Appendix B. Representative statements near the "favorable" pole are:

57. I believe I will learn more from this course than any other I am taking this semester.
55. This course will help me realize my professional or vocational goal.

Two of the statements near the "unfavorable" pole are:

2. I wish I could have avoided taking this course.
5. I have no interest in this subject area.

The procedures for developing the Motivation Scale were those commonly used in Thurstone scaling. We developed a preliminary pool of statements, submitted these statements to judges in order to ascertain median and Q-values for each statement, and selected statements on the basis of these item analysis data for inclusion in the final form of the instrument.

Preliminary Pool of Statements and Judgments

The original pool of statements consisted of 135 items of the type usually included in Thurstone scales. Our instructions to the judges included the following definitions of high and low motivation:

"A highly motivated student is one who really wants to learn whatever it is that the course is concerned with. He may be thus motivated because he perceives the course content as relevant to his vocational or personal interests, or for some other reasons. In any event, the highly motivated student is enthusiastic about the fact that he is taking this course.

"The poorly motivated student does not really want to learn the content of the course. He has little or no intrinsic interest in the subject matter, and does not see it as relevant to his personal or vocational interests. His approach to the course is one of boredom; he regards it without enthusiasm; and is likely to begrudge any time he must spend in connection with it."

An Ancillary Methodological Study.--Since, in developing this scale, it was necessary to secure median and Q-values for distributions of judgments by item, we conducted an ancillary study concerning the judgmental process itself. This study investigated the stability of median and Q-values calculated from judgments obtained from a group administered graphic rating form, and an individually administered sorting procedure.

Although this study is mentioned here primarily to clarify our reason for using two groups of judges, it is appropriate briefly to summarize its findings. Whereas the median scale values obtained from the two judgmental procedures were substantially correlated (.97), graphically derived judgments tended to yield higher Q-values than did sort-derived judgments for relatively unambiguous items. This finding was interpreted in the light of a presumed heightened focusing effect of the sorting procedure for making judgments (Siegel and Siegel, 1962).

Judgmental Procedures.--Eighty-four undergraduates (mostly juniors and seniors) enrolled in two sections of a Business Psychology course served as judges. These judges were randomly divided into two groups of 42 each. One group was required to rate the statements comprising the preliminary item pool by means of a modified graphic procedure; the other to sort the statements into piles.

The judges in both groups received instructions identical in all respects except for the last portion describing the method by which they were to record their judgments. The instructions defined the attitude under consideration ("student motivation for course work") and the equal-appearing intervals continuum to be utilized in judging each of the 135 preliminary statements. This continuum consisted of nine points ranging from 1- Exceedingly Low Motivation, through
5- About Average Motivation, to
9- Exceedingly High Motivation.

Judges using a graphic procedure were presented with a dittoed list of statements and a separate answer sheet. They were instructed to indicate their judgment for each statement by marking in the appropriate column (numbered from 1-9) on the answer sheet. Judges using the sorting procedure were presented with the identical sequence of statements in a deck of cards with one statement per card. These judges were instructed to sort the cards into nine piles corresponding to the nine points on the equal-appearing intervals continuum.

This procedure yielded two distributions of judgments for each of the 135 statements. One of these distributions summarized the judgments for the statement by 42 judges using the graphic rating procedure. The other distribution summarized the judgments of 42 other judges using the sorting procedure. Separate medians and Q-values were computed from each distribution of judgments for every item.

Item Analyses and Final Item Selection

The procedure described above generated two medians and two Q-values for each of the preliminary statements. Whereas the correlation between the medians calculated from the two procedures was exceedingly high, the Q-values resulting from the procedural differences varied as shown in Table 4-4.

Largely because of these data, we decided to accept for further consideration those items yielding Q-values (Q_3 - Q_1) of 2.0 or less by both judgmental procedures. This restricted our attention to 109 of the original 135 statements.

Table 4-4
Disposition of Items as a Function of Stringency of Q Value Criterion

Disposition of items	Q value criterion		
	1.5	1.7	2.0
Retained by both procedures	34	78	109
Rejected by both procedures	56	25	14
Retain by sort: reject by graphic	31	25	8
Retain by graphic: reject by sort	14	7	4
r[a]	.53	.74	.99

[a] Correlations are estimates of Personian r from calculated phi coefficients.

The medians of these 109 statements were ordered in successive half-point intervals and the three "best" statements within each interval were selected for the final version of the scale. The "best" statements were those at each half-point interval with the lowest Q-values. Because the original pool only provided two items with acceptable Q-values at certain median levels, the final version of the Motivation Scale contains 41 scored statements. The range of weights for these statements is 1.1 - 8.5, with a mean weight of 4.9 and a median weight of 5.0.

Standardization

The Motivation Scale is suitable for group administration and is usually completed within 15 minutes. A respondent's score is the median of the weights of the statements with which he "agrees."

Since our interest in developing this scale was to devise a research instrument, this discussion of standardization is limited to three characteristics: reliability, correlations with selected other measures, and score distributions.

Reliability.--The mean split-test reliability corrected for length in the three televised survey courses was .78. These values by course were:

Educational Psychology: .73
Physiology: .81
Zoology: .78

Correlations with Selected Other Measures.--Correlations between the Motivation Scale and other concurrently available scores for the organismic variables are summarized in Table 4-5.

Table 4-5
Correlations between Motivation Scale and Other Concurrent Tests

		Correlation with					
Course	N	ACT Comp.	ESS	Prior Knowl.	Conseq. Remote	Conseq. Obvious	Pertinent Questions
Educational Psychology	145				-.15	.03	-.01
Educational Psychology	208	-.11	-.03	-.06			
Zoology	129	.02	.05	-.02			
Physiology	150	-.16	-.06	.02			
Business Psychology	77	.08	.18	.13			
Shakespeare	78	-.15	-.05	.19			

The intent in constructing the Motivation Scale was to develop a "course-specific" measure: i.e., one reflecting initial interest in and enthusiasm for taking a particular course (rather than motivation for academic work in general). Thus we anticipated that Motivation Scale scores ought not correlate with criteria reflecting level of general academic attainment. Correlations between the Motivation Scale and subsequently earned first semester grade-point-average, second semester grade-point-average, and cumulated two-semester grade-point-average for a sample of 815 freshmen in Educational Psychology were respectively .03, .02, and .00. We can be confident, therefore, that the Motivation Scale is not measuring a general interest in academic work. (The validity of the scale for assessing course-specific motivation is discussed subsequently in the section on Results.)

Score Distributions.--The Motivation Scale was developed about a theoretical midpoint of 5.0. Actual score distributions obtained from samples of students enrolled in five televised courses are summarized in Table 4-6.

As anticipated, median scale scores were more elevated (favorable) in the advanced courses and the preprofessional course (Educational Psychology) than in the two required courses in the core liberal arts program for freshmen and sophomores (Zoology and Physiology).

Table 4-6
Distribution Characteristics of Motivation Scale

Course	N	Range	Median	Q_1	Q_3
Educational Psychology	337	4.8-7.5	6.8	6.4	7.0
Zoology	515	4.6-7.5	6.2	5.2	6.5
Physiology	387	3.8-7.5	6.3	5.9	6.7
Shakespeare*	72	4.6-7.5	6.8	6.3	7.0
Business Psychology*	55	5.3-7.5	6.7	6.4	6.9

* Upper division elective course

Prior Knowledge of the Subject Matter

The purpose of the prior knowledge tests administered in each course was to distribute students along a continuum of subject matter knowledge acquired previous to enrollment in the course. These tests consisted of multiple-choice items drawn from previously administered final examinations.

The distribution characteristics and corrected split-test reliabilities of the prior knowledge tests administered in the three televised survey courses are summarized in Table 4-7. As discussed in Chapter 3, the low reliability coefficients of the prior knowledge tests led us subsequently to disregard organismic variable interactions involving prior knowledge as a component.

Table 4-7
Distribution Characteristics and Corrected Split-Test Reliabilities of the Prior Knowledge Tests (Televised Survey Courses)

	Educational Psychology	Physiology	Zoology
Raw Score Distribution:			
Sample n -	208	150	129
Mean -	12.05	14.40	8.12
Standard deviation -	3.14	3.03	3.04
Corrected Reliability	.43	.36	.66

Ability and Creativity

Our measure of academic ability was composite score on the American College Testing program battery routinely administered to all incoming freshmen at Miami University.

One of our studies (in Educational Psychology, Design C as shown in Figure 3-4) included "creativity" as a potentially interactive learner variable. Two of the creativity tests developed by Guilford and his associates, were used for this assessment and are briefly described below.

Consequences (Christensen, Merrifield, and Guilford, 1958): In this test the respondent is asked to write as many different consequences or results as he can within the time limit, if certain changes were suddenly to take place. (E.g., "What would happen if all national and local laws were suddenly abolished?") The responses are judged as being either "remote" or "obvious." The number of remote responses provided a score for originality; the total number of remote plus obvious responses provided a score for ideational fluency.

Pertinent Questions (Berger, Merrifield, and Guilford, 1960): This test purports to measure conceptual foresight, or the ability to be aware of implications. The format presents a situation requiring a decision and respondents are asked to write questions that must be considered before making that decision.

Selecting Critical Subjects

Following administration of the pretest battery consisting of the instruments discussed in the foregoing sections, the score distributions for each measure were trichotomized: scores at or above the 70th percentile were designated "high"; scores at or below the 30th percentile were designated "low."

Every student enrolled in the course was thus assigned a categorical designation ("high," "middle," "low") for each learner variable. Parallel sets of critical subjects (i.e., students with the desired combinations of learner variable scores) were identified. These sets were randomly assigned to TV receiving rooms wherein the various instructor-environmental conditions were implemented as described in Chapter 5.

It must be re-emphasized here that the critical subjects attended class in receiving rooms with other students. It is extremely unlikely that anyone other than the experimenters knew the identity of these critical subjects.

References

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CHAPTER 5

INSTRUCTOR AND ENVIRONMENTAL CONDITIONS

This chapter describes the procedures for effecting the particular instructor and environmental conditions studied in the series of investigations. As discussed in Chapter 3, these conditions were created by manipulating four variables: (a) personal contact, (b) manifest objectives, (c) proctor, (d) verbal interaction. The two former are regarded as instructor variables; the two latter as environmental variables.

Personal Contact

A number of earlier studies have compared alternate instructional procedures characterized by variation in opportunities for student-teacher contact. It is often inferred from such studies that student-teacher contact may be a relatively unimportant variable at the college level. This inference is supported, for example, by evidence that course examination performance is about the same regardless of whether students are instructed in televised, lecture, or discussion classes (Carpenter and Greenhill, 1958).

In a similar study Macomber and Siegel (1960) also found that subject matter acquisition was relatively uninfluenced by these instructional methods. However their data suggest that differences in instructional procedure may be reflected in performance differences on such higher-order criteria as critical thinking, reduction of stereotypy, and attitude change. Whether or not variations in personal contact were responsible for these differences was not resolved in the Macomber and Siegel study.

There are at least two fairly well defined positions concerning the desirability of student-teacher contact and, consequently, the necessity for discussion-type instruction.

One of these positions is supported by inference from instructional comparisons like those described above. It involves at least the suspicion that some of the arguments for student-teacher contact may be a form of "academic featherbedding."

In contrast, there are two significant bodies of literature purporting to demonstrate not only that student-teacher contact is an important instructional variable, but that its influence may be explicable in terms of clinical theory. One of these is based on the principles of client-centered therapy and includes studies of "student-centered," "non-directive" discussion as opposed to tradition instructor-dominated classroom procedures. The object of nondirective discussion is to encourage greater student participation, involvement and responsibility. Although the findings are not definitive, they generally support student-centered discussion for attaining higher-order educational goals (Anderson, 1959; McKeachie, 1963).

A second body of literature favoring personal contact draws upon identification theory. Identification, which is facilitated by student-teacher contact, is presumed to influence attitude formation and lead to imitative acceptance of such noncognitive instructional outcomes as values and tastes (Adelson, 1962).

Two Dimensions of Personal Contact

In an attempt to facilitate understanding of the instructional effects of student-teacher contact, Siegel and Siegel (1964) differentiatedated between the quantitative and qualitative aspects of this variable.

Sheer amount of personal contact (i.e., student-teacher interaction) can be revealed by logging the proportional amounts of time devoted by the instructor to some kind of verbal interaction with his students. Assuming an instructional environment permitting some amount of personal contact between student and teacher, the qualitative aspect of that contact reflects the intellectual climate in the classroom. As described in Chapter 2, the thrust of a convergent climate for interaction is to facilitate comprehension of those tasks and knowledges germane to the immediate classroom situation; a divergent climate for interaction rewards such behavior by the student as application, synthesis, perception of relationships, and creative problem solving.

In view of the foregoing distinction between the qualitative and quantitative aspects of personal contact, inferences about the importance of contact from studies comparing instructional methods presumed to offer opportunities for varied amounts of contact oversimplify reality. Both student-centered discussion as a technique, and identification as a mechanism, assume that the intellectual climate is somewhat divergent. Obviously, this need not be the case. Students may be given opportunities for contact with the instructor even when the climate is highly convergent. And even though personal contact in an intellectually convergent climate may not necessarily facilitate identification, it may exert other desirable motivating effects for certain kinds of students.

The validity of the expectation that providing opportunities for personal contact of even a rudimentary kind may be positively motivating is supported by analogy from research in other areas. In industry, for example, failure to provide channels for expressing grievances is a source of job dissatisfaction. Similarly in education, lack of an opportunity to interrupt and ask questions is cited by students as a primary source of dissatisfaction with lecture instruction. In both of these instances, the critical factor seems to be the opportunity for personal recognition, and not necessarily the utilization of this opportunity.

Implementing the Conditions

In this series of investigations the personal contact variable was pretty much restricted to its quantitative meaning since the "climate" for televised instruction as it was provided in these courses was quite uniformly convergent. The conditions for the contact variable were simply (a) no personal contact with the instructor, (b) some personal contact with the instructor.

No Personal Contact.--Students in the "no contact" condition were insulated from the instructor in all possible ways. Their only contact with him was mediated by the TV screen. The instructor was never available in the classroom either before or after his TV lecture, and he made no effort to see these students either in his office or elsewhere on the campus.

Some Personal Contact.--Techniques for facilitating some personal contact varied with the course as described below. The primary reason for variations in the procedures for effecting contact was to capitalize as much as possible on the format of the course by making the contact seem reasonable rather than artificial.

Educational Psychology was scheduled for two 75-minute weekly meetings rather than the usual sequence of three 50-minute weekly meetings. All subjects assigned to the contact condition attended class in a single TV viewing room wherein the TV lecturer personally conducted 25-minute discussion periods following each televised lecture. (Parallel discussion periods for the "no contact" groups were conducted by graduate assistants.) The contact thus provided was further reinforced by inviting only students from the instructor-led discussion group to participate in student panels present in the TV studio during the formal lecture periods.

Since Physiology was scheduled for three 50-minute weekly periods, we attempted to provide some personal contact for the selected group of subjects by having the TV instructor appear in their receiving room following each lecture. Although there was not sufficient time for the instructor actually to conduct discussions with this group, we hoped that his regular appearance would encourage these students to ask questions, comment upon the lecture, and generally to interact with the instructor.

In addition to three weekly televised lecture periods, the Zoology course had a required two-hour weekly laboratory. Personal contact was effected by having the TV lecturer himself teach the laboratory sections in which the "contact" subjects were enrolled. All other students, including the "no contact" subjects, were assigned to laboratory sections taught either by other faculty members or graduate assistants.

In attempting to provide personal contact for selected students in Business Psychology, the instructor scheduled weekly seminars in his office. He justified these seminars to the entire class by stating that he wished to maintain a feeling of involvement with students in spite of the fact that the course was televised. In order to do this he was going to invite a "sample" of students to meet with him informally. This "sample" consisted solely of subjects assigned to the contact condition.

The seminars were scheduled at the convenience of the students and were well attended even though attendance was entirely voluntary. The orientation given the seminars by the instructor was "chatty"; although discussion of specific course content was not prohibited, it was not particularly encouraged.

Yet another pattern was used to establish the "personal contact" condition in the Shakespeare course. Since this course was presented live one time and on video-tape three times, the TV instructor actually sat in with his receiving group for the entire semester during the last two video-taped presentations. Although this added an extraneous variable (knowledge that the presentations were video-taped), it effectively facilitated the desired personal contact for these subjects.

Validity of the Conditions

Two items were included in the final examination as a crude check upon the validity of the attempted empirical manipulations to effect the contact and no contact conditions. These items required students to rate (a) how well they felt their instructor had gotten to know them, (b) how well they felt they had gotten to know their instructor. These items were as follows:

A. How well do you feel (instructor's name) has gotten to know you as a person this semester?

   1. He knows me better than any of my other instructors this semester.
   2. He knows me better than most of my other instructors this semester.
   3. He knows me about as well as my other instructors this semester.
   4. He knows less about me than most of my other instructors this semester.
   5. He knows less about me than any of my other instructors this semester.

B. How well have you gotten to know (instructor's name) as a person this semester?

   1. I feel I know him better than any of the other instructors I have had this semester.
   2. I feel I know him better than most of the other instructors I have had this semester.
   3. I know him about as well as my other instructors.
   4. I feel I know less about him than about most of my other instructors this semester.
   5. I feel I know less about him as a person than about any of my other instructors this semester.

Responses to each item were weighted on the five-point continuum as indicated above and summarized for parallel sets of subjects assigned to the contact and no contact conditions. These data appear in Table 5-1.

Table 5-1

Perceived Validity of Opportunities for Personal Contact

Course	Condition	Set #[a]	ITEM					
			A. Perceived Knowledge of Student by Instructor			B. Perceived Knowledge of Instructor by Student		
			Mean	S.D.	t	Mean	S.D.	t
Educational Psychology	Contact	1 (N=16)	2.4	0.8	3.13	3.1	1.0	5.00
	No Contact		3.4	1.0	p <.01	4.5	0.6	p <.01
	Contact	2 (N=16)	2.2	1.1	5.33	3.1	1.2	4.00
	No Contact		3.8	0.5	p <.01	4.5	0.8	p <.01
	Contact	3 (N=16)	2.7	0.8	3.87	3.3	0.3	4.76
	No Contact		3.9	0.9	p <.01	4.3	0.8	p <.01
	Contact	4 (N=16)	2.4	0.8	2.86	3.1	1.1	5.00
	No Contact		3.2	0.7	p <.01	4.5	0.3	p <.01
	Contact	Total (N=64)	2.4	0.9	3.26	3.2	1.0	3.02
	No Contact		3.8	0.8	p <.01	4.5	0.7	p <.01
Physiology	Contact	1 (N=16)	4.3	0.8	2.38	3.6	0.3	5.26
	No Contact		4.8	0.4	p <.025	4.6	0.7	p <.01
	Contact	2 (N=16)	4.0	0.9	3.33	2.9	1.0	5.71
	No Contact		4.9	0.6	p <.01	4.5	0.5	p <.01
	Contact	3 (N=16)	4.3	0.9	2.40	3.1	0.5	11.43
	No Contact		4.9	0.4	p <.025	4.7	0.3	p <.01
	Contact	4 (N=16)	4.1	0.9	2.14	3.7	0.9	2.14
	No Contact		4.7	0.7	p <.025	4.3	0.7	p <.025
	Contact	Total (N=64)	4.2	0.9	1.71	3.3	0.7	3.64
	No Contact		4.8	0.5	p <.05	4.5	0.6	p <.01

Table 5-1 (Cont'd)

	Condition	Set #[a]	ITEM					
			A. Perceived Knowledge of Student by Instructor			B. Perceived Knowledge of Instructor by Student		
			Mean	S.D.	t	Mean	S.D.	t
Zoology	Contact	1 (N=16)	3.3	0.9	2.57	3.8	1.1	3.93
	No Contact		4.2	1.0	p<.01	4.9	0.1	p<.01
	Contact	2 (N=16)	3.8	0.9	0.94	4.4	0.6	2.67
	No Contact		4.1	0.9	ns	4.8	0.1	p<.01
	Contact	3 (N=16)	3.4	0.9	2.81	3.5	0.9	5.00
	No Contact		4.3	0.9	p<.01	4.8	0.5	p<.01
	Contact	4 (N=16)	3.7	0.8	1.90	4.1	1.1	1.49
	No Contact		4.3	1.0	p<.05	4.6	0.8	ns
	Contact	Total (N=64)	3.7	0.9	1.05	4.0	1.0	2.03
	No Contact		4.2	1.0	ns	4.8	0.5	p<.025
Business Psychology	Contact	1 (N=16)	3.6	1.0	2.54	3.4	0.8	4.00
	No Contact		4.4	0.8	p<.01	4.4	0.6	p<.01
	Contact	2 (N=16)	3.1	1.5	3.33	2.7	1.3	3.53
	No Contact		4.5	0.7	p<.01	4.1	0.4	p<.01
	Contact	Total (N=32)	3.4	1.3	4.07	3.1	1.1	5.58
	No Contact		4.5	0.8	p<.01	4.3	0.5	p<.01

[a] N is number of subjects in each condition

Data concerning the effectiveness of our attempts to generate different perceptions in the contact and no contact groups of the Shakespeare course were not available. However the data from the four other courses generally support the effectiveness of our attempts to implement the personal contact condition. With few exceptions, students in the contact groups perceived themselves as knowing and being known to their instructor to a significantly greater extent than those in the no-contact groups.

Manifest Objectives

We conceived of the cognitive attainments emphasized by the instructor as ordered along a continuum. The poles of this continuum were respectively an emphasis upon factual and upon conceptual attainment. The former involves reward for rote learning; the latter involves reward for application and synthesis.

In practice, most instructors probably combine these emphases in formulating and describing their objectives. However as we stated in Chapter 2, there may be a marked discrepancy between a teacher's verbalizations about his objectives to an investigator and the objectives he manifests to his students. Student perceptions of the cognitive attainments emphasized in a course are realistically grounded. These perceptions reflect the way in which the instructor conducts his course rather than a formal statement of objectives which the instructor might be called upon to prepare. As a matter of academic survival, students look for tangible manifestations of the particular kinds of attainment the instructor treats as most important.

One such tangible manifestation is provided by the course examinations. From the student's perspective, the sampling of test items reflects the relative importance attached by the teacher to specific aspects of the course content. Content not sampled on an examination is less important than content that _is_ sampled. There is, of course, a practical reason for student sensitivity to this matter: i.e., they wish to earn a satisfactory course grade. The fact that tests are graded implies an attempt to reward students for learning whatever content the test samples in whatever form it is sampled.

McKeachie (1962) has summarized evidence and speculation about the presumed motivational effects of course examinations as follows:

> "Because grades are important to them, students will learn whatever is necessary to get the grade they desire. If we base our grades on memorization of details, students will memorize the text. If they believe our grades are based upon the ability to integrate and apply principles, they will attempt to do this."

This widely held generalization suggests the possibility of shaping student learning by manipulating the content of course examinations. It implicitly assumes that students as a group are more likely to respond to extrinsic pressures (e.g., to earn grades) than to intrinsic drives. While this is undoubtedly true for some students under some conditions, the generalization is contradicted by a vast literature on individual differences. Furthermore it suggests a mechanistic model of teaching-learning at variance with the "participation and involvement" models favored by Rogers (1961) and Ericksen (1962).

There is little question that the content of course examinations does, in fact, exert some influence upon student learning. However there is no evidence that this influence is uniformly exerted upon all students under all classroom conditions. Furthermore, there is no evidence that the direction of this influence, even when it occurs, is always positive.

Viewed in terms of our paradigm for exploring the instructional gestalt, the influence of course examinations upon learning is at least partly due to the fact that students interpret them as representations about the instructor's objectives. As such, they are part of the total instructional configuration and interact with other elements of this configuration in determining how much learning and what kind of learning will transpire.

Implementing the Manifest Objective Conditions

Three one-hour multiple-choice examinations were administered during the semester in each course. Two forms of each examination were developed. One of these forms, designed to manifest a factual objective, consisted solely of items judged to demand only rote recall for the factual content and principles previously presented in lectures and assigned readings. The other form manifested a conceptual objective by containing only items requiring students to apply factual information to previously unencountered situations, or to synthesize and integrate factual information in some new way. The content coverages of the two forms of each examination were judged by the instructor to be parallel.

The factual and conceptual forms were consistently administered to half the subjects throughout the semester. The intent was consistently to emphasize factual learning for half of them and conceptual learning for the other half.

Proctor

The presence or absence of a proctor in the TV receiving room was systematically controlled. Certain rooms were proctored during every class meeting; others were unproctored throughout the semester. The proctors were either graduate or senior undergraduate assistants charged with maintaining attendance records and enforcing a satisfactory level of discipline. (The only exception to this limited set of functions occurred in certain sections of Educational Psychology wherein the proctors were also given responsibility for conducting post-lecture discussions. This exception is discussed below in the context of the description of verbal interaction as a variable.)

Attendance in unproctored sections was verified and encouraged by random distribution in these sections of attendance sheets. No external influences were brought to bear in unproctored sections for enforcing discipline. Although discipline deteriorated somewhat in the unproctored sections of all courses, the deterioration was most severe in Physiology--a point to which we will return in our subsequent discussion of results.

The presence or absence of a proctor was included in the design for two reasons. First, since these investigations were conducted in televised courses, knowledge about the influence (if any) of a proctor as a feature of the instructional environment has obvious practical significance. Secondly, in broader perspective, the proctor is an authoritative figure. Students in unproctored sections were implicitly given greater responsibility for guiding their own in-class behavior than were students in the proctored sections. Thus we anticipated that data on the interactions between this and other aspects of the instructional gestalt would provide leads for delimiting the role of self-determined classroom behavior in optimizing instructional outcomes. To the extent that the "proctor" as a variable may be more broadly interpreted in this way, our findings concerning its influence should have implications for a wide range of instructional settings other than that provided in televised courses.

Verbal Interaction

"Student participation in classroom discussion" is a phrase denoting a complex set of variables. At minimum it is possible to distinguish between the quantitative and qualitative aspects of such participation. A particular instructional environment provides opportunities for student participation varying both in amount and kind.

The amount of participation possible or required obviously differs, for example, in the case of programmed and televised instruction. The former requires continual participation by the student if it is to proceed at all. However, the latter may continue at an uninterrupted pace regardless of whether a given student is taking notes, thinking about what he is hearing, attempting to relate the lecture to what he already knows or has experienced, daydreaming, or even physically absent.

In face-to-face instruction, the teacher himself monitors the amount of participation. Lecturers encourage varying amounts of interruption; and discussion leaders differ markedly in the relative proportion of participation-time permitted their students and themselves.

The qualitative aspect of student participation emanates from and contributes to the intellectual climate of the instructional setting as discussed in Chapter 2. Granting the existence of some participation, it makes a difference whether this is limited to attempts at clarifying the substantive content or is extended to permit genuine intellectual and emotional exploration of the ramifications and implications of that content.

The foregoing description of these two components of "student participation" is cursory and is not meant to provide an analysis of the components of this complex set of variables. However even on the basis of such a rudimentary analysis, it is evident that the many studies of "large lecture" vs. "conventional" instruction usually have neglected appropriate controls for these factors.

As indicated in Figure 3-4, we included a kind of student participation as a component variable in one of our designs (Design B - Educational Psychology). This was effected by having the graduate assistant proctors in certain sections of this course conduct a 25-minute "discussion" period following each 50-minute televised lecture. Since there was no control over the amount of participation by any given subject, it is more accurate to say that we systematically provided an opportunity for participation than that we provided participation *per se*.

The nature of the participation was confined within reasonable limits to attempts to clarify the content of the immediately preceding TV lecture. Students were given an opportunity to ask questions about the lecture content. The proctors were "primed" with questions of their own to stimulate "discussion" if none emanated from the class itself. Since the proctors were beginning graduate students, the verbal participation by the subjects was not permitted to move too far beyond the substantive content of the immediately preceding lecture.

Since this variable was not primary in the sense of pervading all of our designs, the controls indicated above were deemed adequate. The variable we will henceforth abbreviate for convenience as "verbal interaction" was really provision (or inhibition) of the opportunity to raise questions after each lecture about the content of that lecture.

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CHAPTER 6

DEPENDENT VARIABLES

Of all the problems besetting psychoeducational research, the criterion problem is certainly one of gravest importance. The search for appropriate research criteria has often had the beneficial effect of focusing the attention of both investigator and teacher upon desired instructional outcomes. These outcomes are then reflected in the structure of course examinations used to assess what students have learned. Occasionally, course examinations are supplemented with instruments designed to measure such less tangible or more elegant objectives as attitudinal change and critical thinking. Regardless of their nature, the overwhelming emphasis in developing criteria for educational research is upon instruments administered at or very near the completion of the course.

As we indicated in Chapter 1, such post-course criterion measures may suffer considerable contamination in higher educational settings. The investigator typically wishes to evaluate the effectiveness of some instructional procedure from student performance on the final examination. Realistically, however, final examination performance reflects a variety of variables other than the ones under study. To cite an extreme instance of such criterion contamination, it is quite possible for students to earn high final examination scores without ever attending a class meeting. This is so because they have access to sources of information other than face -to-face contact with the instructor: textbooks, and comprehensive notes taken by a friend who does attend class are but two such sources.

Furthermore, although a final examination may be carefully structured in accord with instructional objectives, it may lack sensitivity as a research criterion. This would be the case, for example, when the effects of the independent variable are cumulative and gather strength throughout the semester. Since postcourse examination scores typically reflect learning throughout the entire course when the independent variable effects have been both weak and strong, such examinations have a tendency to mask cumulative effects (Siegel, 1960).

These two defects of postcourse examinations as research criteria, contamination and lack of sensitivity, suggest the importance of an entirely different kind of criterion. Certain types of investigations could be enhanced by utilizing an immediate rather than a delayed criterion measure, reflecting the impact of independent variables *in situ* and thereby free from contamination by extraneous factors.

Guided by this logic, we elected to use two classes of dependent variables for this series of studies. These were (a) end-of-course assessments of acquisition, (b) assessments of student thinking *in situ*.

Acquisition

The two-hour final examination in each course was purposely structured to provide two part scores: one for factual acquisition, and one for conceptual acquisition. The items contributing to the factual acquisition score required students to recall or recognize information that had previously been presented to them in the lectures, textbooks, assigned readings, and so on. These items did not require the respondents to apply this information in any way or to make any modifications of it. In structuring them, the instructors attempted to represent only the lowest levels of the hierarchy of cognitive objectives presented in the Taxonomy of Educational Objectives (Bloom, 1956).

A second score was computed for items sampling conceptual acquisition. These items required respondents either to apply facts in solving previously unencountered problems or to relate facts previously presented as discrete in order to generate principles. It is important to emphasize that the classification of a criterion item as "factual" or "conceptual" depended upon our inferences about the cognitive operations required of the respondents by the item rather than upon the appearance or superficial content of the item. If, for example, an item dealt with an application of a principle that was presented either in the text or the lecture, it was classified as "factual" since it would have been possible to answer correctly solely on the basis of rote recall.

Statistical Characteristics

All of the scores for the acquisition criteria were derived from responses to sets of multiple-choice items with two exceptions. These scores were simply the number of items correctly answered.

The exceptions were the examinations administered in the Shakespeare course. The factual score was based upon a set of completion items (80-point maximum). The conceptual score was based upon an essay examination with raw scores computed on the basis of a 100-point maximum. These examinations were independently graded by two readers: the instructor and the graduate assistant assigned to the course. Since there was considerable agreement in the scores assigned by these readers, their scores were averaged as long as they were within ± 5 points of each other. In the relatively few instances of more substantial disagreement, the paper was reread by the instructor who then made a final score determination.

Table 6-1 summarizes the distributional characteristics of the acquisition criteria scores and the estimated reliabilities of these measures. Since the Kuder Richardson formula 21 underestimates test reliability when its underlying assumptions are not met, the acquisition criteria were, for the most part, regarded as sufficiently reliable for research purposes. The exceptions to this generalization were the measures obtained in Business Psychology, and particularly the one for conceptual acquisition.

Table 6-1

Characteristics of the Acquisition Measures

Criterion		Course				
		Educational Psychology	Zoology	Physiology	Business Psychology	Shakespeare
Factual Acquisition	n of items	76	95	106	52	- -[b]
	Mean	51.72	32.55	72.97	43.25	36.05
	Standard Deviation	8.68	8.50	12.07	3.93	14.50
	Reliability	0.79[a]	0.71[a]	0.85[a]	0.54[a]	- -[b]
Conceptual Acquisition	n of items	74	55	82	48	- -[c]
	Mean	45.47	27.57	49.95	34.29	69.94
	Standard Deviation	7.93	7.09	7.61	3.62	16.76
	Reliability	0.73[a]	0.74[a]	0.67[a]	0.26[a]	- -[c]

a. Estimates are calculated from Kuder Richardson Formula 21.

b. A completion examination; reliability not estimated.

c. An essay examination; reliability not estimated.

Developing the Stimulated Recall Technique

The two remaining criteria involved assessments of the quality of student thinking during a sample of lecture presentations. The technique developed for this purpose generates scores for (a) thought relevance and (b) inattentiveness (Siegel, Siegel, et al, 1963). Because this is a special kind of criterion measure its development and implementation is discussed in considerable detail in this section.

Background

A technique for assessing students thought processes in class and a demonstration of the potential usefulness of such an assessment was first presented by Bloom (1953). He tabulated categories of student thinking during class periods in an attempt to make a diagnostic assessment of the relative strengths and weaknesses of lecture versus discussion presentations of subject matter. The technique for evoking records of student thinking is termed stimulated recall. The entire class period was recorded on audio tape. These tapes were subsequently played during individual interviews with students within 24 hours after the original class period. The tape was stopped at "critical points" and the interviewee was asked to attempt to relive the original experience and recall what he was thinking during the stimulus lecture or discussion.

The stimulated recall technique described above was suitable for Bloom's purpose but lacked the refinements required of criterion instruments. It yielded percentage summaries of student thoughts assigned in terms of a classificatory scheme rather than scores along some kind of continuum of student thinking.

Stimulating recall by audio tape with delayed playback to evoke a record of thinking during the original classroom presentation suffers from at least three major difficulties. First, the period of delay (up to a maximum of 24 hours) between the initial presentation and playback may increase the likelihood that respondents will forget or suppress the thoughts they experienced during the original presentation. Second, audio tape reproduces only a portion of the original classroom experience. To the extent that cues in addition to auditory ones could be introduced to stimulate recall, the resultant memory ought to be more complete. Finally, the technique of collecting data from individual student interviews is obviously laborious.

In order to circumvent these difficulties, we developed a technique whereby (a) stimulated recall trials were conducted almost immediately following the original presentation, (b) the original presentation was recorded on video tape and students observed the playback from the same seats in the same classroom environment as the original presentation, (c) data were simultaneously collected in written form from the entire group of students enrolled in the course.

The remainder of this section describes the development of this criterion with special attention to our attempts to (a) design a scoring system reflecting relevance of thinking, (b) ascertain the reliability with which raters could convert these written records of thinking to the numerical scale of relevance, (c) determine the consistency of students' stimulated recall scores across trials encompassing different subject matter presentations on different days, and (d) estimate the validity of the scores derived from the stimulated recall technique.

Developmental Procedure

All data pertaining to the development of this criterion were gathered in four televised sections of the Educational Psychology course during the year preceding initiation of the instructional gestalt studies. Stimulated recall trials were not attempted until after mid-semester in order to enable students to become accustomed to the routine of attending a televised class. It was feared, were this not done, that some students might use stimulated recall trials merely as an outlet for expressing personal feelings about TV instruction.

The procedure for conducting a stimulated recall trial was as follows.

The stimulus lecture (20 minutes in length) was recorded on video tape several days in advance of the scheduled trial. This taped lecture did not differ in any way from the usual lecture except for its abbreviated length. During the taping, the experimenter observed from the studio and noted the position on the tape of possible "critical points." A critical point was grossly identified as any point in the lecture that would be likely to evoke some kind of student thinking. Operationally, at such points, the lecturer generally asked a question, defined a term, or attempted to synthesize and relate concepts. Finally, three to five critical points were selected from each lecture: the first of these 4-5 minutes after the lecture began, and the succeeding ones spaced at 3-5 minute intervals.

On the day of the stimulated recall trial, the taped lecture was presented on TV. Students were given no indication that the lecture was taped rather than live, that it was to run for only 20 minutes, or that anything unusual would occur during the class period.

The stimulus lecture terminated with the instructor introducing the experimenter to the class as a researcher. The experimenter asked the proctor who had just come into the receiving room to administer the tests with which he had been provided. One of these tests was designed to validate the stimulated recall procedure and is discussed subsequently in more detail.

Upon completion of the testing (approximately 20 minutes), the experimenter reappeared on camera to prepare the students for the stimulated recall trial. He explained that the lecture just seen had been recorded on video tape; it would be replayed from the beginning; students were to attempt to adopt the "frame of mind" they had at the beginning of the class period and "relive" the first 20 minutes of the hour; the tape would be interrupted at several critical points; at each of these stops the respondent was to write on the sheet provided him "whatever he was thinking at that point during the original presentation." Assurances were given concerning the confidential nature of the replies.

Following this introduction, the tape was replayed from the beginning, hopefully taking the viewers back about 45 minutes in time. It was stopped at the first critical point by prearrangement with the studio staff, and the experimenter repeated the instruction to "write down what you were thinking at this point during the original presentation." A time lapse of 2 minutes was allowed for students to write their thoughts, and the tape was started from the preceding stopping place. This procedure was followed for all stops within a trial.

Three such trials were conducted with this group of students. The first trial involved a portion of a lecture on visual defects and had three stops; the second stimulus lecture concerned fundamental concepts in psychological measurement and had four stops; the third lecture concerned projective techniques and had five stops. Thus for each subject we obtained his statement of thoughts _in situ_ on 12 occasions, sampling three lectures spaced over approximately a 5-week period.

The validation test administered in one viewing section between the end of the stimulus lecture and the beginning of the stimulated recall playback was mentioned above briefly. This achievement test contained two kinds of items: "critical" items measuring knowledges conveyed at or immediately preceding each scheduled stimulated recall stop; and "control" items measuring knowledges conveyed within the chapter of the textbook from which the lecture was drawn but not discussed or implied in the lecture itself. Each of these tests contained 2 critical items for each stimulated recall stop and between 10 and 12 control items. Across the three trials, we obtained scores for each subject on 24 critical items and 34 control items.

The score on the control items reflected knowledges acquired in these three topical areas from extra-class sources. The score on the critical items reflected the influence of these extra-class sources of information in combination with exposure to the lecture. Hence, as a test of validity of stimulated recall, the total stimulated recall scores across the three trials (indicating relevance of thinking) were correlated with the critical item subscores partialing out the control item subscores. This partial correlation reflects the validity of students' reports about their thinking against a criterion of acquisition corrected for knowledges acquired from sources other than the class lecture.

Developmental Results

The findings are most conveniently summarized under four headings: Scoring for Relevance of Thinking, Interrater Reliability, Validity, and Intratrial and Intertrial Consistency.

Scoring for Relevance of Thinking.--Bloom (1953) suggested a system for coding (but not for weighting) thoughts evoked by his stimulated recall procedure. Our first step in developing a scoring system was to code the data using Bloom's categories. This coding was accomplished independently after a minimum amount of preliminary training by statistical clerks serving as judges. Two judges coded each stop.

The coding categories with illustrations of each are reproduced below. These are identical to Bloom's categories with the exception of Classification IIf, added to handle a number of responses in our study.

I. Irrelevant thoughts

  a. Thoughts about persons, objects and events not in the classroom environment ("I was wondering if John would ask me to go to the dance on Saturday.")
  b. Tangential thoughts about words and phrases used in the lecture ("Myopia sure is a funny sounding word." "Mr. X sure says 'uh' a lot while he lectures.")

II. Relevant thoughts

  a. Passive thoughts about the subject ("I was just taking notes." "Just listening.")
  b. Thoughts evidencing simple comprehension of the subject ("Somebody with tunnel vision would have to move his eyes around to see things at the sides.")
  c. Thoughts involving attempts to apply and utilize the subject matter ("I am nearsighted and was thinking about becoming farsighted later in life and probably having to wear bifocals.")
  d. Thoughts involving attempts to find solutions to problems or synthesize the subject ("He [instructor] said that much special training is required to interpret projectives correctly. I wonder how practical they are for routine use. Can't they be put in an objectively scorable form?")
  e. Thoughts involving evaluation of the meaningfulness and accuracy of the lecture ("I don't believe you can tell very much from a figure drawing. Talent would enter into what you draw.")
  f. Thoughts wherein questions beyond the presentation are asked ("Is it unusual for a person to make more than one response to either a part of a blot or the whole blot?")

In using this system of coding, each judge read the reported thought and decided first whether subject's thinking was relevant or irrelevant. Then he assigned the appropriate code designation indicating the category of relevant or irrelevant thinking into which he judged it to fit. Whenever a subject reported both relevant and irrelevant thoughts at a given stop, the judge always assigned the code designation only for the relevant thought.

Four experimenters independently rated the eight coding classifications using the paired-comparisons technique. Every classification was compared with every other classification and a judgment made about which represented the "more relevant" thinking. Similar paired-comparison judgments were made by seven persons who had considerable prior experience in actually coding stimulated recall responses.

Summaries of these two sets of paired-comparison ratings agreed closely. The code categories were distributed along a continuum of "thinking relevance" on the basis of these ratings in accord with the following numerical weights:

Irrelevant thoughts (Ia and Ib) = 0
Relevant thoughts
IIa, IIb = 2
IIc, IIe, IIf = 4
IId = 5

These weights were applied to the coded thought contents and summed across stops for each trial to yield "trial scores," and across the three trials to yield total scores. All analyses of stimulated recall data subsequently described involved the utilization of these weights and scores.

Interrater Reliability.--Each stimulated recall response was coded independently by two judges. Correlations between the numerical conversions for each pair of judgments are summarized for 225 subjects in Table 6-2.

Table 6-2
Interrater Reliabilities

Trial	Stop	r	
I	1	.69	
	2	.76	
	3	.70	
Total score			.77
II	1	.57	
	2	.49	
	3	.59	
	4	.64	
Total score			.70
III	1	.62	
	2	.55	
	3	.47	
	4	.56	
	5	.55	
Total score			.65

Interrater reliabilities for the 12 stops ranged between .47 and .76 with a median value of .58. When total trial scores were considered, interrater agreement ranged from a low of .65 on Trial 3 to a high of .77 on Trial 1. Since our raters received relatively little preliminary training, it is likely that these coefficients are minimum estimates of the interrater reliability that may be anticipated in scoring stimulated recall data.

Discrepancies between the weights assigned to given responses by pairs of judges were arbitrated by experimenters prior to conducting the validity and consistency studies described in the following sections.

Validity.--The crux of the utility of stimulated recall as a criterion of student thinking is its validity. Do students' reports about what they were thinking at various points in the stimulus lecture correlate with an independent measure of what they have learned at these points solely as a result of the lecture? Presumably, students indicating that they were inattentive to the presentation ought to have learned very little from it. Conversely, students reporting highly relevant thinking should be expected to show a parallel gain in knowledge from the stimulus lecture.

As described earlier, the design for validation involved administration of an achievement test consisting of subsets of critical items and control items in one of the viewing sections (N=47). Performance on the control items was assumed to reflect information in the general area of the lecture topic acquired from sources other than the lecture presentation itself.

The correlation matrix for total scores (across the three trials) on critical items, control items, and stimulated recall is shown in Table 6-3. The correlation between stimulated recall and critical item scores partialing out the control item scores was .61. It is evident that stimulated recall scores do, in fact, correlate with a measure of achievement reflecting knowledges gained from the lecture itself. The higher the level of thinking relevance displayed by a student during stimulated recall, the greater is the likelihood that he will learn the knowledges conveyed during the lecture.

Table 6-3
Intercorrelations Between Scores on Critical Achievement Items, Control Achievement Items, and Stimulated Recall

Item	Critical Items	Control Items	Stimulated Recall
Critical	X	.28	.59
Control		X	.02

Note.--N=47.

Intratrial and Intertrial Consistency.--The factors affecting the internal consistency of stimulated recall responses parallel those affecting the internal consistency of achievement test item responses. However, one aspect of stimulated recall is uniquely important: the character of student thinking may be presumed to be particularly sensitive to fluctuations of interest during a given stimulus lecture and in different lectures.

The developmental design sampled thinking during three different lectures and at three to five points within each lecture. The intercorrelations reflecting intratrial and intertrial consistency of thinking are exhibited in Table 6-4.

Although the means and standard deviations of relevance scores are relatively stable, the intratrial and intertrial correlations tend to be fairly low. Hence, there is no strong evidence for the existence of characteristic patterns or "styles" of thinking.

Relevance of Thinking and Inattentiveness

Using the evidence summarized above, we incorporated the stimulated recall technique into our design to provide two criterion scores: relevance of thinking and inattentiveness.

The procedure for accumulating the stimulated recall data and scoring these responses for relevance of thinking was as described in the foregoing discussion. The score for "inattentiveness" was simply the count of the zero-weighted (i.e., irrelevant) thoughts. Table 6-5 summarizes the number of stimulated recall trials and stops from which these criterion data were derived in each course. This table also summarizes the distributional characteristics of relevance and inattentiveness scores for samples of students in each course.

Criterion Intercorrelations

The intercorrelations between the four criteria by course are reported in Table 6-6. These correlations were computed for samples of students drawn from the total enrollment (including both subjects and other students) in these courses.

The very substantial correlations uniformly obtained between the two scores from stimulated recall led us subsequently to use only one of these (relevance of thinking) as a criterion. Findings based upon the count of irrelevant responses ("inattentiveness") will be reported but not discussed in any great detail.

The correlations between the two acquisition measures do not preclude their treatment as different, although related, criteria. It is evident furthermore that the acquisition and thinking measures were sampling two quite different kinds of criterion behavior.

Table 6-4
Intratrial and Intertrial Consistency of Stimulated Recall Scores

Trial	Trial I				Trial II					Trial III					
	1	2	3	Total	1	2	3	4	Total	1	2	3	4	5	Total
M	1.73	1.88	1.58	5.20	1.39	1.76	1.59	1.63	6.44	1.31	1.54	1.52	1.41	1.47	7.33
SD	1.34	1.35	1.39	2.97	1.27	1.28	1.35	1.42	3.32	1.17	1.07	1.09	1.16	1.00	3.22
I															
Stop 1	X	.35	.22												
Stop 2		X	.34												
Stop 3			X												
Total score									.25						.29
II															
Stop 1					X	.27	.28	.15							
Stop 2						X	.23	.13							
Stop 3							X	.13							
Stop 4								X							
Total score															.29
III															
Stop 1										X	.14	.13	.13	.08	
Stop 2											X	.28	.16	.19	
Stop 3												X	.30	.20	
Stop 4													X	.35	
Stop 5														X	

Note.--N = 225.

Table 6-5

Characteristics of the Stimulated Recall Measures

	Course				
	Educational Psychology	Zoology	Physiology	Business Psychology	Shakespeare
Number of Stimulated Recall Trials:	3	2	2	3	4
Total Number of Stops:	12	12	10	13	17
Relevance:					
Mean	18.90	17.12	14.51	22.12	26.86
Standard Deviation	8.22	8.06	6.76	7.88	10.79
Inattentiveness:					
Mean	3.88	4.27	4.53	4.04	6.73
Standard Deviation	2.53	3.05	2.24	2.79	3.94

Table 6-6
Criterion Intercorrelations

Course	Criterion → ↓		Acquisition		Thinking	
			Fact.	Concept.	Rele.	Inatten.
Educational Psychology (N=208)	Acquisition	Factual	X			
		Conceptual	.74	X		
	Thinking	Relevance	.12	.22	X	
		Inattention	-.13	-.14	-.74	X
Zoology (N=129)	Acquisition	Factual	X			
		Conceptual	.66	X		
	Thinking	Relevance	.13	.18	X	
		Inattention	-.12	-.16	-.95	X
Physiology (N=150)	Acquisition	Factual	X			
		Conceptual	.44	X		
	Thinking	Relevance	.16	.20	X	
		Inattention	-.15	-.22	-.85	X
Business Psychology (N=77)	Acquisition	Factual	X			
		Conceptual	.45	X		
	Thinking	Relevance	.29	.16	X	
		Inattention	-.32	-.13	-.88	X
Shakespeare (N=78)	Acquisition	Factual	X			
		Conceptual	.61	X		
	Thinking	Relevance	.23	.08	X	
		Inattention	-.12	-.04	-.84	X
All Courses	Acquisition	Factual	X			
		Conceptual	.62	X		
	Thinking	Relevance	.17	.18	X	
		Inattention	-.16	-.15	-.86	X

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PART III

RESULTS AND DISCUSSION

Chapter 7. An Overview of Results in Televised Survey Courses

Chapter 8. Main Effects and Intra-Cluster Interactions

Chapter 9. Two Organizing Concepts: Instructional Press and Idiosyncratic Drive Pattern

Chapter 10. Extrinsic Facilitators and Inhibitors: Ability-Linked Drive Patterns

Chapter 11. Extrinsic Facilitators and Inhibitors: Set-Linked Drive Patterns

Chapter 12. Advanced Televised Courses

The data from the pattern of investigation described in Part II can be interpreted at two levels. First, each of the variables included in the design can be considered in its own right as it affects instructional outcomes. This rudimentary level of interpretation is undertaken in Chapter 8.

A more significant type of interpretation is possible when the interactions between learner variables and instructor-environment conditions are considered. We have elected to discuss these interactions in terms of two organizing concepts described in Chapter 9: i.e., instructional press and idiosyncratic drive patterns.

Chapters 10 and 11 integrate the data obtained in the televised survey courses. The three televised survey courses to which we will be referring in Chapters 7-11 were Educational Psychology, Zoology, and Physiology. These courses were all included in the University's common curriculum program. Thus they shared the objective of providing an over-all survey of a discipline to students who were required to register for the course in order to satisfy either a graduation option or a requirement. These courses were alike also in enrolling primarily freshmen and sophomores.

We have elected not to distinguish in this discussion between the hypotheses we held prior to and following data collection in order further to establish the exploratory nature of these investigations and to simplify the presentation.

Although the discussion presents our preferred generalizations, we recognize throughout that given sets of data may sometimes support alternative a priori hypotheses and suggest alternative a posteriori "explanations". In choosing from among these alternatives we were guided by some of our earlier attempts to interpret findings from preliminary explorations of the instructional gestalt (Siegel and Siegel, 1964) and by the broader literature of educational research.

The focus is changed in Chapter 12 from the televised survey courses to two advanced courses also taught by television: Business Psychology and Shakespeare. The hypotheses derived in the preceding chapters are here applied in an attempt to predict performance in two courses not previously considered.

CHAPTER 7

AN OVERVIEW OF RESULTS IN TELEVISED SURVEY COURSES

The data with which Chapters 7 - 12 are concerned were all derived from a 2^7 design implemented in three courses: Educational Psychology, Zoology, and Physiology. The entire design was replicated during subsequent years in Zoology but, as discussed earlier, such replication was impossible in the other two courses.

The analysis of variance matrix for this design in each course consisted of the four learner variables, two instructor variables and one environmental variable listed below:

Learner Variables:

Academic Ability (Ab)
Motivation (Mot)
Educational Set (S)
Prior Knowledge (PK)

Instructor Variables:

Manifest Objective (O)
Personal Contact (Con)

Environmental Variable:

Proctor (Pr)

The reader is referred to Chapter 3 for clarification of the overall design, Chapter 4 for information about the learner variables, and Chapter 5 for a discussion of the instructor-environment variables.

Four analysis of variance matrixes were generated for each course. Two of these contained entries for the acquisition measures (factual and conceptual acquisition), and two contained entries for quality of thinking (relevance of thinking and inattentiveness). The nature and characteristics of these criteria were discussed in Chapter 6.

Analysis of Variance Summaries

Table 7-1 summarizes the results obtained from the eight analyses concerning acquisition in the televised survey courses. Parallel data for the analyses of thinking *in situ* are displayed in Table 7-2.

Although segments of these Tables will be extracted and separately presented throughout the discussion in the ensuing chapters, it is interesting simultaneously to examine all data derived from this particular design. In these as well as all subsequently presented analysis of variance summaries, only statistically significant F-ratios are cited.

Selected portions of these tables are discussed in Chapters 8-11. However, preliminary to these discussions it is appropriate to comment further upon our interpretation of reported significance levels.

Table 7-1

Acquisition in Televised Survey Courses

Source	Factual Acquisition								Conceptual Acquisition							
	Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F
Proctor (Pr)	28		30		30		1785	15.35^{c}	0		4		8		262	10.10^{c}
Manifest Objective (O)	18		6		34		313		3		37		3		9	
Personal Contact (Con)	2		32		5		1105	9.50^{c}	9		2		44		71	
Academic Ability (Ab)	1876	45.96^{c}	1081	14.32^{c}	1313	24.23^{c}	2720	23.39^{c}	2329	87.34	1146	17.72^{c}	1660	47.42^{c}	591	22.81^{c}
Motivation (Mot)	32		316	4.19^{b}	17		11		15		273	4.23^{b}	3		0	
Educational Set (S)	91		316	4.19^{b}	300	5.54^{b}	253		36		439	6.79^{b}	341	9.64^{c}	33	
Prior Knowledge (PK)	587	14.37^{c}	61		98		6		205	7.69^{c}	189	2.91^{a}	389	11.00^{c}	256	9.88^{c}
Pr x O	276	6.76^{b}	25		23		120		109	4.08^{a}	22		4		24	
Pr x Con	2		288	3.82^{a}	18		18		4		39		16		33	
Pr x Ab	0		36		63		43		1		1		17		14	
Pr x Mot	55		55		58		81		25		89		111	3.13^{a}	37	
Pr x S	15		0		5		8		5		12		35		0	
Pr x PK	109		2		8		0		4		13		2		24	
O x Con	2		1		0		9		17		39		51		1	
O x Ab	20		7		88		3		5		25		6		1	
O x Mot	120	2.94^{a}	124		215	3.97^{a}	25		1		16		13		0	
O x S	72		30		36		9		0		86		1		42	
O x PK	20		3		18		94		0		103		13		3	
Con x Ab	313	7.66^{c}	53		162	2.99^{a}	18		38		65		27		13	
Con x Mot	30		109		25		162		72		24		1		138	5.33^{b}
Con x S	4		0		167	3.07^{a}	94		153	5.74^{b}	114		14		31	
Con x PK	18		11		140		1		4		4		35		1	
Ab x Mot	58		109		23		58		66		20		56		2	
Ab x S	319	7.81^{c}	5		98		105		50		27		12		39	
Ab x PK	5		75		85		98		1		25		2		27	
Mot x S	85		48		242	4.47^{b}	2		11		8		35		2	
Mot x PK	23		17		78		45		0		29		147	4.15^{a}	10	
S x PK	81		14		124		53		0		37		1		31	
Pr x O x Con	53		34		91		167		26		0		3		14	
Pr x O x Ab	7		23		88		98		124	4.65^{b}	2		1		2	
Pr x O x Mot	6		3		1		120		32		1		31		0	
Pr x O x S	6		140		6		14		32		31		1		77	2.96^{a}
Pr x O x PK	38		124		105		3		20		0		20		39	
Pr x Con x Ab	32		215		13		25		11		213	3.29^{a}	24		2	
Pr x Con x Mot	30		63		120		1		1		118		3		12	
Pr x Con x S	345	8.44^{c}	124		43		5		1		62		25		103	3.99^{a}
Pr x Con x PK	28		3		1		306		149	5.58^{b}	33		29		75	2.90^{a}
Pr x Ab x Mot	0		270	3.57^{a}	26		751	6.46^{b}	2		188	2.90^{a}	6		11	
Pr x Ab x S	69		7		0		8		0		126		0		6	

Table 7-1 (Cont'd)
Acquisition in Televised Survey Courses

Source	Factual Acquisition								Conceptual Acquisition							
	Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F
Pr x Ab x PK	91		0		1		113		195	7.31^c	1		29		4	
Pr x Mot x S	36		26		2		15		11		12		16		33	
Pr x Mot x PK	195	4.78^b	30		32		28		162	6.07^c	1		1		11	
Pr x S x PK	3		7		11		0		2		17		0		33	
O x Con x Ab	1		253	$3,35^a$	72		17		9		16		89		59	
O x Con x Mot	23		1		25		11		32		25		3		4	
O x Con x S	1		2		2		336	2.91^a	3		54		9		279	10.77^c
O x Con x PK	78		78		23		210		69		59		35		164	6.34^b
O x Ab x Mot	109		128		34		36		2		297	4.59^b	107	3.02^a	22	
O x Ab x S	11		113		85		17		15		1		19		89	3.45^a
O x Ab x PK	8		2		8		3		0		19		1		59	
O x Mot x S	6		0		41		4		14		1		178	5.04^b	39	
O x Mot x PK	205	5.02^b	8		45		23		36		103		8		68	
O x S x PK	9		21		282	5.21^b	113		6		9		68		75	2.90^a
Con x Ab x Mot	32		72		0		181		0		8		122	3.45^a	4	
Con x Ab x S	113		0		149		176		15		62		86		89	3.45^a
Con x Ab x PK	185	4.54^b	162		14		17		195	7.31^c	57		19		4	
Con x Mot x S	20		55		26		2		17		3		31		7	
Con x Mot x PK	0		0		1		64		50		25		3		5	
Con x S x PK	0		10		1		32		21		33		9		71	
Ab x Mot x S	3		45		98		5		0		14		51		20	
Ab x Mot x PK	21		2		32		2		1		1		6		2	
Ab x S x PK	3		6		124		149		10		3		4		56	
Mot x S x PK	20		10		158	2.91^a	1		14		31		118	3.34^a	13	
Pr x O x Con x Ab	300	7.35^c	8		105		30		167	6.24^b	5		134	3.79^a	1	
Pr x O x Con x Mot	38		1		1		226		6		42		3		44	
Pr x O x Con x S	30		36		43		231		41		8		8		12	
Pr x O x Con x PK	21		18		248	4.57^b	72		4		10		19		10	
Pr x O x Ab x Mot	17		338	4.48^b	9		242		15		203	3.13^a	130	3.68^a	142	5.50^b
Pr x O x Ab x S	38		78		13		604	5.20^b	61		49		20		5	
Pr x O x Ab x PK	50		153		36		770	6.62^b	185	6.95^b	74		3		68	
Pr x O x Mot x S	55		66		10		81		69		13		16		8	
Pr x O x Mot x PK	205	5.02^b	72		28		5		32		12		25		65	
Pr x O x S x PK	34		8		248	4.57^b	61		8		5		65		13	
Pr x Con x Ab x Mot	66		1		98		61		5		27		10		7	
Pr x Con x Ab x S	8		6		43		282		1		12		49		25	
Pr x Con x Ab x PK	46		13		48		5		81	3.05^a	29		1		27	
Pr x Con x Mot x S	17		8		81		5		43		33		25		20	
Pr x Con x Mot x PK	5		25		7		226		1		0		39		9	
Pr x Con x S x PK	41		78		5		1		5		51		1		86	3.32^a
Pr x Ab x Mot x S	1		5		50		36		1		35		122	3.45^a	0	
Pr x Ab x Mot x PK	45		0		6		242		55		14		44		0	
Pr x Ab x S x PK	392	9.60^c	28		158	2.91^a	23		50		0		146	4.15^a	6	

Table 7-1 (Cont'd)
Acquisition in Televised Survey Courses

Source		Factual Acquisition								Conceptual Acquisition							
		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
		MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F	MS^{x}	F
Pr x Mot x S x PK		43		1		2		9		0		5		10		20	
O x Con x Ab x Mot		2		109		78		30		0		39		0		96	3.72^{a}
O x Con x Ab x S		1		1		47		484	4.17^{b}	2		1		4		208	8.01^{c}
O x Con x Ab x PK		176	4.31^{b}	20		158	2.91^{a}	66		63		3		11		39	
O x Con x Mot x S		3		23		58		181		0		33		0		13	
O x Con x Mot x PK		3		23		5		172		5		9		7		46	
O x Con x S x PK		5		26		0		43		1		80		13		7	
O x Ab x Mot x S		53		140		13		0		0		2		2		1	
O x Ab x Mot x PK		21		30		1		63		10		6		17		1	
O x Ab x S x PK		78		43		116		13		265	9.92^{c}	39		7		49	
O x Mot x S x PK		149	3.65^{a}	20		75		105		63		20		11		31	
Con x Ab x Mot x S		32		5		167	3.07^{a}	4		5		0		49		1	
Con x Ab x Mot x PK		75		63		116		43		18		51		20		62	
Con x Ab x S x PK		43		75		13		231		18		19		17		0	
Con x Mot x S x PK		120		109		36		21		58		89		17		77	2.96^{a}
Ab x Mot x S x PK		18		413	5.47^{b}	7		0		20		122		89		25	
	df	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS
Total	127		9454		9114		8924		18817		6567		7491		6363		5217
Error	29	40.79	1183	75.50	2189	54.18	1571	115.81	3358	26.64	772	64.66	1875	35.37	1026	25.90	751

$^{x}d_f = 1$ always; MS and SS are identical

a/$P < .10$; b/$P < .05$; c/$P < .01$

Table 7-2
Relevance of Thinking and Attentiveness in Televised Survey Courses

Source	Relevance of Thinking								Inattentiveness							
	Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F
Proctor (Pr)	13		81		1		1029	20.10^c	5		5		1		83	16.78^c
Manifest Objective (O)	32		45		173	3.04^a	4		5		2		35	3.70^a	2	
Personal Contact (Con)	694	9.37^c	428	9.42^c	126		33		58	7.85^c	17	2.93^a	20		5	
Academic Ability (Ab)	553	7.46^b	1		111		0		26	3.57^a	3		6		14	2.92^a
Motivation (Mot)	140		58		126		1		25	3.33^a	1		29	3.07^a	1	
Educational Set (S)	113		6		46		424	8.28^c	3		0		14		37	7.53^b
Prior Knowledge (PK)	63		6		0		183	3.57^a	5		2		2		17	3.49^a
Pr x O	215	2.91^a	75		14		19		3		5		5		2	
Pr x Con	0		21		2		0		1		1		2		1	
Pr x Ab	28		38		138		111		5		3		16		12	
Pr x Mot	21		6		10		6		5		0		0		3	
Pr x S	237	3.19^a	9		83		27		15		1		11		12	
Pr x PK	13		20		7		13		10		1		0		0	
O x Con	8		1		80		11		0		0		31	3.27^a	2	
O x Ab	13		41		6		29		8		0		9		0	
O x Mot	2		5		7		59		2		5		1		4	
O x S	3		1		65		5		0		0		10		0	
O x PK	1		5		80		46		1		0		7		17	3.49^a
Con x Ab	63		14		345	6.05^b	9		8		2		49	5.15^b	1	
Con x Mot	1		41		126		0		2		3		22		0	
Con x S	50		53		3		51		7		5		0		7	
Con x PK	2		0		142		3		2		1		13		14	2.92^a
Ab x Mot	248	3.34^a	48		96		147	2.86^a	7		10		19		9	
Ab x S	15		1		3		3		3		0		1		1	
Ab x PK	7		15		0		3		5		1		0		0	
Mot x S	1		9		62		39		6		0		7		2	
Mot x PK	7		26		3		22		0		11		0		8	
S x PK	288	3.89^a	2		2		24		50	6.79^b	3		1		2	
Pr x O x Con	3		1		239	4.20^b	111		1		0		37	3.93^a	10	
Pr x O x Ab	34		5		3		25		3		0		5		0	
Pr x O x Mot	0		2		46		25		2		0		13		3	
Pr x O x S	242	3.27^a	3		20		12		34	4.62^b	0		6		6	
Pr x O x PK	69		7		10		100		4		0		10		6	
Pr x Con x Ab	8		171	3.77^a	49		0		2		36	6.39^b	2		7	
Pr x Con x Mot	5		30		100		83		3		3		20		12	
Pr x Con x S	3		32		54		12		5		5		5		0	
Pr x Con x PK	5		3		31		13		0		4		9		3	
Pr x Ab x Mot	66		595	13.11^c	35		74		4		43	7.57^c	1		2	
Pr x Ab x S	102		17		4		3		9		1		0		0	
Pr x Ab x PK	0		14		0		62		1		15		1		10	
Pr x Mot x S	43		25		0		3		8		2		0		0	

Table 7-2 (Cont'd)

Relevance of Thinking and Attentiveness in Televised Survey Courses

Source	Relevance of Thinking								Inattentiveness							
	Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F
Pr x Mot x PK	2		113		31		11		1		10		4		2	
Pr x S x PK	14		0		122		19		1		0		11		1	
O x Con x Ab	1		58		439	7.70^{c}	33		1		8		65	6.83^{b}	9	
O x Con x Mot	13		5		0		44		2		1		0		12	
O x Con x S	58		38		16		10		1		7		5		0	
O x Con x PK	6		116		80		7		0		9		1		3	
O x Ab x Mot	15		11		70		0		2		5		3		1	
O x Ab x S	43		0		118		74		0		3		20		5	
O x Ab x PK	5		45		0		68		6		2		1		8	
O x Mot x S	1		43		2		49		0		3		0		10	
O x Mot x PK	153		1		0		51		17		0		2		2	
O x S x PK	5		91		160		0		2		11		25		0	
Con x Ab x Mot	38		61		25		12		10		0		4		0	
Con x Ab x S	3		3		11		16		0		5		4		1	
Con x Ab x PK	1		75		155		9		0		13		6		0	
Con x Mot x S	200		0		2		25		14		0		3		2	
Con x Mot x PK	4		18		6		62		0		1		0		10	
Con x S x PK	6		48		19		77		0		0		9		7	
Ab x Mot x S	5		14		8		39		3		4		1		5	
Ab x Mot x PK	124		0		17		25		14		4		4		0	
Ab x S x PK	15		0		3		4		0		0		0		0	
Mot x S x PK	91		26		19		103		8		10		4		7	
Pr x O x Con x Ab	2		50		5		0		0		2		1		1	
Pr x O x Con x Mot	17		53		62		83		1		0		19		24	4.79^{b}
Pr x O x Con x S	6		265	5.83^{b}	96		49		0		25	4.34^{b}	8		8	
Pr x O x Con x PK	20		36		19		20		2		3		0		3	
Pr x O x Ab x Mot	0		36		35		51		0		2		2		1	
Pr x O x Ab x S	32		3		151		35		10		0		24		2	
Pr x O x Ab x PK	488	6.59^{b}	11		25		56		41	5.50^{b}	4		1		2	
Pr x O x Mot x S	21		55		178	3.13^{a}	2		3		5		25		1	
Pr x O x Mot x PK	11		28		0		11		2		0		1		0	
Pr x O x S x PK	1		14		51		19		0		2		10		0	
Pr x Con x Ab x Mot	50		102		17		3		18		4		1		0	
Pr x Con x Ab x S	81		32		68		178	3.48^{a}	13		30	5.32^{b}	10		14	2.92^{a}
Pr x Con x Ab x PK	1		253	5.58^{b}	22		17		2		0		2		3	
Pr x Con x Mot x S	23		17		59		178	3.48^{a}	1		0		8		20	4.12^{b}
Pr x Con x Mot x PK	72		9		134		56		2		3		20		31	6.28^{b}
Pr x Con x S x PK	0		72		31		130		1		0		10		12	
Pr x Ab x Mot x S	0		0		80		6		2		0		7		3	
Pr x Ab x Mot x PK	221	2.98^{a}	8		93		151	2.95^{a}	38	5.20^{b}	0		2		22	4.44^{b}
Pr x Ab x S x PK	1		7		83		0		5		7		12		1	
Pr x Mot x S x PK	176		36		107		68		6		10		12		4	

Table 7-2 (Cont'd)

Relevance of Thinking and Attentiveness in Televised Survey Courses

	Relevance of Thinking								Inattentiveness							
	Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology		Educational Psychology		Zoology 61-62		Zoology 62-63		Physiology	
	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F
O x Con x Ab x Mot	45		6		54		49		11		1		3		6	
O x Con x Ab x S	116		95		6		1		4		2		4		1	
O x Con x Ab x PK	0		3		126		56		1		0		12		20	4.12^a
O x Con x Mot x S	149		36		19		44		15		3		3		3	
O x Con x Mot x PK	32		2		111		9		1		0		1		1	
O x Con x S x PK	38		7		126		103		8		0		2		2	
O x Ab x Mot x S	38		75		0		126		5		1		1		4	
O x Ab x Mot x PK	8		1		3		9		3		0		1		1	
O x Ab x S x PK	0		8		1		0		1		0		0		0	
O x Mot x S x PK	9		1		13		33		4		0		1		0	
Con x Ab x Mot x S	8		36		8		1		1		10		2		0	
Con x Ab x Mot x PK	5		41		0		27		3		8		0		11	
Con x Ab x S x PK	41		43		35		77		0		1		2		5	
Con x Mot x S x PK	8		120		126		59		3		11		29	3.07^a	5	
Ab x Mot x S x PK	0		0		29		44		3		2		4		7	
d_f	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS
Total 127		8074		5598		7363		6796		839		586		1102		757
Error 29	74.09	2149	45.39	1317	56.97	1652	51.21	1485	7.36	213	5.65	164	9.47	275	4.94	143

$^x d_f$ = 1 always; MS and SS are identical

$^a/P < .10$; $^b/P < .05$; $^c/P < .01$

Table 7-3

Number of Significant Fourth, Fifth and Sixth Order Interactions: Televised Survey Courses

Interactions	Acquisition								Thinking in situ							
	Factual				Conceptual				Relevance				Inattentiveness			
	Educ. Psychol.	Zoo. (61-62)	Zoo. (62-63)	Physiol.	Educ. Psychol.	Zoo. (61-62)	Zoo. (62-63)	Physiol.	Educ. Psych.	Zoo. (61-62)	Zoo. (62-63)	Physiol.	Educ. Psych.	Zoo. (61-62)	Zoo. (62-63)	Physiol.
4th Order																
$p < .10$	1	0	1	1	2	1	2	0	0	4	2	2	0	2	5	4
$p < .05$	2	0	0	4	0	0	1	0	0	0	5	0	0	3	3	1
$p < .01$	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$p > .10$	15	21	20	16	19	20	18	21	21	17	14	19	21	16	13	16
5th & 6th Order																
$p < .10$	0	0	1	0	1	1	1	0	1	1	0	0	1	0	0	0
$p < .05$	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
$p < .01$	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
$p > .10$	8	6	6	8	6	6	7	7	7	7	8	8	7	8	8	8
Total SS	9454	9114	8924	18817	6567	7491	6363	5217	8074	5598	7363	6796	839	586	1101	757
4th Order																
SS	1074	1085	977	2899	313	1104	727	501	1359	1030	1473	1086	137	134	239	117
MS	51.14	51.67	46.52	138.05	14.90	52.57	34.61	23.86	64.71	49.05	70.14	51.71	6.52	6.38	11.38	5.57
5th & 6th Order																
SS	109	1104	594	459	192	771	299	250	790	287	179	399	76	30	36	26
MS	13.67	138.03	74.26	57.37	24.02	96.39	37.33	31.22	98.71	35.88	22.33	49.88	9.49	3.74	4.49	3.29

Reported Significance Levels

As we discussed in Chapter 3, the 10 per cent level of confidence was selected as our criterion of statistical significance because of the tendency to underestimate significance when some of the interactions comprising the error term are themselves statistically significant. It is necessary now further to justify this procedure for identifying significant F-ratios and to comment upon the proportion of such ratios exhibited in Tables 7-1 and 7-2.

Our Use of $p < .10$

The error term consists of all interactions at and above the fourth order. Of these 29 higher order interactions, 21 are fourth order, 7 are fifth order, and 1 is sixth order. We tested the significance of each of the fourth-order interactions using the mean square of the eight highest order interactions as the error term. Similarly, we tested the significance of each of the fifth- and sixth-order interactions using the mean square of the 21 fourth-order interactions as the error term. The pertinent data are summarized in Table 7-3.

For the sixteen analyses of variance with which Part III of this report is concerned, the number of significant higher order interactions ranged between one and eight. The higher the number of significant interactions included in the error term for calculating the F-ratios in Tables 7-1 and 7-2, the greater is the likelihood that this term underestimates the significance of the F-ratios and, hence, the more defensible is our use of the .10 p level.

The data in Table 7-3 support this practice for all analyses except those for Physiology--conceptual acquisition and relevance of thinking, and Educational Psychology--relevance of thinking and inattentiveness. In these four analyses, the interactions significant with $p < .10$ are suspect. Since there is a clear danger of "over-interpreting" them, they are not considered further in the discussion of results.

The validity of interpretating interactions where $p < .10$ may also be questioned in the analyses for Zoology 61-62 for factual and conceptual acquisition. However the situation in this course was unique in that the entire analysis was replicated (Zoology 62-63). Therefore these interactions are interpreted when they appear consistently.

Proportions of Significant F-Ratios

Although the summaries provided in Tables 7-1 and 7-2 cite only those F-ratios that are statistically significant, all ratios were calculated for each matrix. Thus we computed 98 F-ratios for each analysis of variance matrix summarized in these tables.

A number of these 98 F-ratios would be expected to emerge as "statistically significant" solely on the basis of chance. However the actual number of such false positives included in Tables 7-1 and 7-2 is indeterminate because the indicated p levels overestimate chance probabilities by unknown amounts.

We attempted to guard against interpreting chance findings in three ways. First, we sought consistent findings across courses. Although there was no reason to demand such consistency before allowing ourselves to interpret a significant F-ratio, the consistencies that *did* appear were comforting. Second, we approached data interpretation with some *a priori* hypotheses. These hypotheses focused our attention upon specific F-ratios. Third, in formulating *a posteriori* generalizations that seemed to "fit" some of our data and therefore to merit further study, we endeavored always to interpret what we perceived as clusters of significant findings rather than isolated significant findings.

CHAPTER 8

MAIN EFFECTS AND INTRA-CLUSTER INTERACTIONS

This chapter is restricted in scope to a discussion of the main effects for each of the variables and of the interactions between the learner variables and between the instructor-environment variables. Thus the chapter considers evidence for first-order generalizations: i.e., generalizations about the impact of each variable or condition without regard for the learner-instructor-environment interactions.

These first-order generalizations are gross approximations which will be modified in subsequent chapters. Whereas we will present evidence here, for example, that high ability students acquire more than low ability students, the discussions in Chapters 9-11 will refine this generalization by specifying certain conditions under which it is tenable and untenable. Similarly, although we will generalize here about the superiority of a conceptual over a factual learning set, we will subsequently indicate some limits for this generalization.

Thus the discussion throughout the remainder of Part III is cumulative. We begin in the present chapter with gross findings which are refined in the subsequent chapters.

Learner Variables

This section is primarily concerned with the main effects of and interactions between three of the learner variables: motivation, academic ability, and educational set. A fourth learner variable, prior knowledge, was not assessed with sufficient reliability to permit generalizations about its influence.

The pertinent results are shown in Tables 8-1 through 8-4.

Table 8-1 displays the correlations between learner variable scores and the criteria. These correlations were computed for random samples of the full student enrollment in each course.

Table 8-2 was extrapolated from Tables 7-1 and 7-2 and shows the mean squares only for the learner variable main effects and interactions. This table does not show the third-order interaction even though this was computed. Subgroup means for the significant main effects are summarized in Table 8-3.

For reasons discussed earlier, certain interactions in Physiology and Educational Psychology with $p < .10$ were not regarded as statistically significant. Subgroup means for the significant interactions are summarized in Table 8-4.

Table 8 - 1

Correlations Between Learner Variables and Criteria

Variable	Criterion	Course			
		Educational Psychology (n = 208)	Zoology (n = 129)	Physiology (n = 100)	All Courses (n = 437)
Motivation	Factual Acquisition	-.03	.07	-.03	.00
	Conceptual Acquisition	-.02	.06	.11	.03
	Thought Relevance	$.13^{x}$	$.17^{x}$	$.20^{x}$	$.16^{xx}$
Academic Ability	Factual Acquisition	$.54^{xx}$	$.55^{xx}$	$.25^{xx}$	$.49^{xx}$
	Conceptual Acquisition	$.60^{xx}$	$.62^{xx}$	$.31^{xx}$	$.55^{xx}$
	Thought Relevance	$.13^{x}$	$.18^{x}$	-.09	$.09^{x}$
Educational Set	Factual Acquisition	$.18^{x}$	$.24^{xx}$	-.02	$.15^{xx}$
	Conceptual Acquisition	$.28^{xx}$	$.31^{xx}$	.08	$.24^{xx}$
	Thought Relevance	$.12^{x}$	.10	.16	$.12^{x}$

x $p < .05$
xx $p < .01$

Table 8-2

Analysis of Variance Summary: Learner Variables Only

Course:	Educational Psychology						Zoology (61-62)						Zoology (62-63)						Physiology					
Criterion:	Factual		Conceptual		Relevance		Factual		Conceptual		Relevance		Factual		Conceptual		Relevance		Factual		Conceptual		Relevance	
	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p
Academic Ability (Ab)	1876	.01	2329	.01	553	.05	1081	.01	1146	.01	1		1313	.01	1660	.01	111		2720	.01	591	.01	0	
Motivation (Mot)	32		15		140		316	.05	273	.05	58		17		3		126		11		0		1	
Educational Set (S)	91		36		113		316	.05	439	.05	6		300	.05	341	.01	46		253		33		424	.01
Prior Knowledge (PK)	587	.01	205	.01	63		61		189	.10	6		98		389	.01	0		6		256	.01	183	xx
Ab x Mot	58		66		248	xx	109		20		48		23		56		96		58		2		147	xx
Ab x S	319	.01	50		15		5		27		1		98		12		3		105		39		3	
Ab x PK	5		1		7		75		25		15		85		2		0		98		27		3	
Mot x S	85		11		1		48		8		9		242	.05	35		62		2		2		39	
Mot x PK	23		0		7		17		29		26		78		147	.10	3		45		10		22	
S x PK	81		0		288	xx	14		37		2		124		1		2		53		31		24	
Ab x Mot x S	3		0		5		45		14		14		98		51		8		5		20		39	
Ab x Mot x PK	21		1		124		2		1		0		32		6		17		2		2		25	
Ab x S x PK	3		10		15		6		3		0		124		4		3		149		56		4	
Mot x S x PK	20		14		91		10		31		26		158	.10	118	.10	19		1		13		103	
Error MS	40.79		26.64		74.09		75.50		64.66		45.39		54.12		35.37		56.97		115.81		25.90		51.21	

^{x}df = 1 always; MS and SS are identical

xx $p < .10$ but not regarded as statistically significant

Table 8-3

Subgroup Means for Significant Main Effects: Learner Variables

Learner Variable	Course	Factual Acquisition M_H^x	Factual Acquisition M_L	Conceptual Acquisition M_H^x	Conceptual Acquisition M_L	Thought Relevance M_H^x	Thought Relevance M_L
Academic Ability	Educational Psychology	55.79	48.15	49.54	41.00	22.90	18.76
	Zoology (61-62)	34.51	28.71	32.64	26.66	-	-
	Zoology (62-63)	35.75	29.35	30.90	23.70	-	-
	Physiology	75.24	66.04	50.78	46.48	-	-
Motivation	Educational Psychology	-	-	-	-	-	-
	Zoology (61-62)	33.17	30.05	31.11	28.19	-	-
	Zoology (62-63)	-	-	-	-	-	-
	Physiology	-	-	-	-	-	-
Educational Set	Educational Psychology	-	-	-	-	-	-
	Zoology (61-62)	33.17	30.05	31.50	27.80	-	-
	Zoology (62-63)	34.08	31.02	28.93	25.67	-	-
	Physiology	-	-	-	-	14.20	10.56
Prior Knowledge	Educational Psychology	54.11	49.83	46.53	44.01	-	-
	Zoology (61-62)	-	-	30.80	28.50	-	-
	Zoology (62-63)	-	-	29.04	25.56	-	-
	Physiology	-	-	50.04	47.22	-	-

x M_H is mean of "high" learner variable subgroup: i.e., high ability, high motivation, conceptual set, or high prior knowledge

Table 8-4

Subgroup Means for Significant Interactions: Learner Variables Only

Interaction	Course	Criterion	p	Interacting Variables			
Ab x S	Educational Psychology	Factual	.01			High Ability	Low Ability
					Conceptual S	55.06	50.56
					Factual S	56.53	45.71
Mot x S	Zoology (62-63)	Factual	.05			High Motivation	Low Motivation
					Conceptual S	35.81	32.34
					Factual S	30.00	32.03
Mot x PK	Zoology (62-63)	Conceptual	.10			High Motivation	Low Motivation
					High PK	29.97	28.13
					Low PK	24.34	26.78
Mot x S x PK	Zoology (62-63)	Factual	.10			High Motivation	Low Motivation
				High PK	Conceptual S	39.56	32.31
					Factual S	29.56	32.25
				Low PK	Conceptual S	32.06	32.38
					Factual S	30.44	31.81
		Conceptual	.10			High Motivation	Low Motivation
				High PK	Conceptual S	33.19	28.37
					Factual S	26.75	27.87
				Low PK	Conceptual S	25.44	28.75
					Factual S	23.50	24.81

Motivation (Mot)

The student's initial level of interest in and enthusiasm for his enrollment in the course was assessed with the "motivation" scale described in Chapter 4. We sought, by means of this scale, to measure one kind of intrinsic drive brought into the classroom by the student.

However intrinsic factors like "interest in taking the course" or even the more general "drive for learning" or "desire to learn for the sake of learning" are not the only ones affecting student performance. Students also respond to such externally directed drives as the desire to maintain grades, be graduated, gain approbation from parents, be accepted by peers, be accepted by teachers, and so on.

The relative importance of these intrinsic and extrinsic forces is idiosyncratic, as discussed in Chapter 9. However we are here concerned only with an _intrinsic_ component of this idiosyncratic drive pattern.

Acquisition.--It would have been naive to expect _a priori_ that highly motivated students would acquire more than poorly motivated students--at least as measured by our criteria of acquisition. Since these criteria were extracted from the final course examinations, performance on them was subject to many influences. Grades, graduation, and approbation all depended upon satisfactory examination scores. In other words, the students were simply not free to choose to learn or not to learn; external requirements compelled acquisition.

This line of reasoning is consistent with the uniform pattern of nonsignificant correlations between motivation scale scores and the two acquisition criteria displayed in _Table 8-1_.

These low correlations have an interesting negative implication. Student performance on the final examination and, by inference, acquisition of the content sampled by that examination is uncorrelated with initial level of interest in the subject area. Although this conclusion must be tempered by considering the level of the course and the type of instructional procedure investigated, it nonetheless supports the importance we will subsequently assign to the role of external pressures in compelling academic performance by certain types of students.

The main effects for _Mot_ are shown in _Table 8-2_. Although _Mot_ was assessed in the same way for the data in _Tables 8-1_ and _8-2_, the two sets of data were derived from different samples of students. Correlations were computed for random samples of the total course enrollment including both critical subjects and other students enrolled in the course. The F-ratios were computed for samples consisting entirely of critical subjects. In effect, the main effects shown in _Table 8-2_ were obtained with matched and balanced groups. They show the effect of precourse attitudes when other aspects of the instructional gestalt were held constant by design.

Thought Relevance.--There seemed to be good reason, _a priori_, for expecting Mot to relate more to the criterion of thought relevance than to the acquisition measures. Thoughts transpiring during a lecture ordinarily are privately held by the student. External pressures compelling performance are probably not as powerful under conditions of such privacy. Students are more free to think relevantly or irrelevantly during a lecture than they are to learn or not learn the content sampled by the final examination.

The pattern of correlations for the motivation scale (Table 8-1) supports this expectation. Significant correlations were obtained only between Mot and thought relevance. The fact that these correlations were not higher, even though statistically significant and uniformly obtained in all courses, implies that even privately held educational behavior may be much influenced by external variables contributing to the instructional gestalt.

Pre-Course Attitudes as "Sensitizers."--The data presented thus far indicate that Mot (i.e., pre-course attitudes) is only a minimally effective determinant of instructional outcomes as revealed by main effects and zero order correlations. This does not mean that this intrinsic factor is inconsequential to the educational process. Instead it may simply mean that external pressures may "wash out" the influence of motivational factors, particularly when the performance in question is related to course grades.

Aside from exerting an effect of its own, the constellation of attitudes comprising Mot may act to increase or decrease the potency of certain other intrinsic characteristics. This "sensitizing" effect of Mot is evident in Zoology (62-63) as shown in Tables 8-2 and 8-4. Here favorable pre-course attitudes maximized the performance discrepancies attributable to educational set and prior knowledge. (We must temporarily defer consideration of reasons for this "sensitizing" effect occurring in Zoology but not in the two other courses.)

Academic Ability (Ab)

As shown in Tables 8-1 through 8-4, powerful main effects were obtained with academic ability for both criteria of acquisition. This finding is interesting only because of the contrast between the strong relationships evident for the acquisition criteria and the weak relationships evident for the measures of thinking in situ.

Educational Set (S)

The assumption underlying our assessment of educational set was that certain students are predisposed to want to learn factual information, others to learn conceptual information, and still others to learn some mix of these two extremes. Thus educational set was presumed to reflect the learner's broad cognitive style as a "given" with which he enters the course.

By the time a student is an undergraduate his educational set can be reliably assessed and probably is quite firmly established (see Chapter 4). We believe this set to be an integral component of the learner's broad personality configuration and to operate by sensitizing him to particular features of the instructional environment.

Other things being equal, we anticipated that conceptually set students would be more likely than factually set students to perform well on all of our criterion measures. This expectation followed from Ausubel's (1963) notion of subsumption. In terms of this notion, a conceptual posture would predispose factual learning because the learner is thereby enabled to place facts in an idiosyncratically meaningful context. A conceptual set should also predispose conceptual acquisition and relevant thinking because the learner so set seeks continually to enlarge and refine his cognitive structure.

A factual set, on the other hand, predisposes the learner to regard facts as having an integrity of their own. Since the factually set learner may be presumed not to subsume facts readily, this set ought to interfere with both acquisition and relevance of thinking.

Again referring to Tables 8-1 through 8-4 and temporarily ignoring differences in results as a function of course, it is evident that the data support this expectation derived from Ausubel's notion of subsumption. Generally speaking, a conceptual set predisposes more effective educational performance than does a factual set.

Instructor - Environment Variables

We consider next the main effects and intra-cluster interactions for the three extrinsic (instructor-environment) variables included in the basic design: proctor, manifest objective, and personal contact. The pertinent findings are summarized in Tables 8-5 through 8-7.

Proctor (Pr)

The primary reason for including the proctor (and, as an alternative condition, no proctor) as an investigated condition was that these studies were conducted in televised courses. We anticipated that educational performance would be favored under the proctored condition.

This was indeed the case in Physiology for all three criteria. However it is important to note that the presence or absence of a proctor did not influence performance in either Educational Psychology or Zoology except as this variable interacted with other instructor -environment variables.

The absence of a main effect for this variable in the latter two courses combined with the presence of a very strong main effect in Physiology contributed to the development of the concept of instructional press which we will discuss in Chapter 9.

Manifest Objective (O)

It is often stated, and generally accepted, that students will learn whatever is necessary to get the grade they desire. To the extent

Table 8-5

Analysis of Variance Summary: Instructor - Environment Variables Only

Course:	Educational Psychology						Zoology (61-62)						Zoology (62-63)						Physiology					
Criterion:	Factual		Conceptual		Relevance		Factual		Conceptual		Relevance		Factual		Conceptual		Relevance		Factual		Conceptual		Relevance	
	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p
Proctor (Pr)	28		0		13		30		4		81		30		8		1		1785	.01	262	.01	1029	.01
Manifest Objective (O)	18		3		32		6		37		45		34		3		173	.10	313		9		4	
Personal Contact (Con)	2		9		694	.01	32		2		428	.01	5		44		126		1105	.01	71		33	
Pr x O	276	.05	109	.10	215	xx	25		22		75		23		4		14		120		4		19	
Pr x Con	2		4		0		288	xx	39		21		18		16		2		18		33		0	
O x Con	2		17		8		1		39		1		0		51		80		9		1		11	
Pr x O x Con	53		26		3		34		0		1		91		3		239	.05	167		14		111	
Error MS	40.79		26.64		74.09		75.50		64.66		45.39		54.12		35.37		56.97		115.81		25.90		51.21	

^{x} df = 1 always; MS and SS are idential

$^{xx}p < .10$ but not regarded as statistically significant

Table 8-6

Subgroup Means for Significant Main Effects: Instructor - Environment Variables

Variable	Course	Factual Acquisition M_1	Factual Acquisition M_2	Conceptual Acquisition M_1	Conceptual Acquisition M_2	Thought Relevance M_1	Thought Relevance M_2
Proctor x	Educational Psychology	-		-			-
	Zoology (61-62)	-		-			-
	Zoology (62-63)	-		-			-
	Physiology	74.37	66.91	50.06	47.20	15.21	9.55
Manifest Objective xx	Educational Psychology	-		-			-
	Zoology (61-62)	-		-			-
	Zoology (62-63)	-		-		15.60	17.92
	Physiology	-		-			-
Personal Contact xxx	Educational Psychology	-		-		23.16	18.50
	Zoology (61-62)	-		-		23.76	20.12
	Zoology (62-63)	-		-			-
	Physiology	73.57	67.71	-			-

x M_1 - Proctor; M_2 - No Proctor

xx M_1 - Manifest Conceptual Objective; M_2 - Manifest Factual Objective

xxx M_1 - Personal Contact; M_2 - No Personal Contact

Table 8-7

Subgroup Means for Significant Interactions: Instructor - Environment

Variables Only

Interaction	Course	Criterion	p	Interacting Variables			
						Pr	No Pr
Pr x O	Educational Psychology	Factual	.05		Conceptual O	51.34	53.34
					Factual O	53.53	49.65
		Conceptual	.10			Pr	No Pr
					Conceptual O	44.25	46.00
					Factual O	46.37	44.43
Pr x O x Con	Zoology (62-63)	Relevance				Pr	No Pr
				Contact	Conceptual O	16.38	18.38
					Factual O	19.19	17.06
				No Contact	Conceptual O	15.31	12.31
					Factual O	15.81	19.63

this is so, it should be possible to shape learning by manipulating examination content. And in terms of this series of studies, main effects favoring the manifest conceptual objective condition should be expected when the criterion is conceptual acquisition whereas main effects favoring the manifest factual objective condition should be expected when the criterion is factual acquisition.

As shown in Table 8-5, these expectations were not corroborated. Significant main effects were not obtained for the manifest objective variable. Furthermore in one course, Educational Psychology, the pattern of acquisition as a function of the interaction O x Pr was identical for the factual and conceptual criteria.

One interpretation of this failure to shape acquisition in the anticipated direction by means of the three hourly course examinations used to establish the O conditions is that the treatments were simply not sufficiently powerful. An alternative explanation, and the one we prefer, is that generalizations to the effect that students learn whatever content the instructor emphasizes on his tests are gross oversimplifications.

In Chapters 10 and 11 we will make a case for the influence of examination content being determined by the appropriateness of the content for individual students rather than by the nature of the content as objectively defined. To anticipate this discussion briefly, we will hypothesize that educational outcomes are best attained when the examination content

a) constitutes a challenge appropriate to the student's level of ability and prior knowledge of the subject matter;
b) compensates for deficiencies in intrinsically derived motivation for performance;
c) rewards students for learning the kind of information *they* consider interesting and/or important.

Personal Contact (Con)

Several studies of the effectiveness of large group instructional procedures have raised questions about the importance of student-teacher contact in higher education. Since the usual comparison between performance outcomes in "experimental" (with little or no personal contact) and "control" (with some amount of personal contact) does not usually yield significant performance differences, it is sometimes inferred that student-teacher contact has been overvalued in higher education.

In the present study the "personal contact" condition provided only minimal opportunities for such contact as described in Chapter 5. This condition was compared with the "no contact" condition wherein students were deliberately prevented from meeting personally with their instructor.

The pertinent data, shown in Tables 8-5 and 8-6, indicate that opportunity for even minimal personal contact cannot be lightly dismissed. Students given this opportunity in Educational Psychology and Zoology tended to think at a higher level of relevance than did students denied any opportunity for personal contact with the instructor. This finding is consistent with the literature on identification with an instructor -model if we assume that the opportunity for personal contact facilitates such identification.

Whereas a main effect for personal contact was not obtained in Physiology when the criterion was relevance of thinking, a significant main effect was obtained in this course for factual acquisition.

Discussion

This chapter has summarized evidence for certain gross generalizations about each of the variables included in the design. These generalizations are compiled below.

1. Students' pre-course attitudes (Mot) predict relevance of thinking more effectively than acquisition scores. An important difference between these two kinds of criterion behavior is that the former is essentially private whereas the latter is publicly visible. Thus the power of Mot may depend upon the constraints upon performance imposed by environmental circumstances.

2. Favorable pre-course attitudes (high Mot) may maximize the power of other learner variables as determinants of performance. Conversely unfavorable pre-course attitudes (low Mot) may "wash out" the effects of these other learner variables.

3. Academic ability is a particularly potent predictor of acquisition but not of relevance of thinking.

4. Conceptually set students tend to perform better than factually set students. This finding is consistent with the principle of subsumption discussed by Ausubel.

5. Classroom supervision (Pr) may or may not affect academic performance depending upon other characteristics of the course. When it does affect academic performance, the positive influence of the proctor's presence is strong and pervades all criteria.

6. The content of hourly course examinations administered during the semester (O) does not alone effectively shape the direction of acquisition. Instead, as we will show subsequently, the influence of course examination content depends upon the interactions of O with the learner variables.

7. Even opportunity for minimal personal contact between student and instructor (Con) may have beneficial effects upon academic performance.

The generalizations summarized above are approximations. All of them will be elaborated and refined in the chapters following this one. Thus by proceeding from an analysis of the gross impact of the variables studied to an increasingly refined analysis, we hope to demonstrate the power of a multivariate paradigm in contrast with simpler research strategies.

This presentation of main effects and intra-cluster interactions provides us with a convenient point of entry into the analysis and interpretation of the more complex learner-instructor-environment interactions. Furthermore, it emphasizes two important points.

First, whereas each of the variables under consideration may make a unique contribution of its own to determining performance levels, these variables differ in power. As we have seen, academic ability is an extremely powerful determinant of acquisition; however the influence of pre-course attitude was weaker than we might have anticipated a priori.

Second, the power of these variables is situational. There were several instances where findings obtained in one course were not corroborated in another course. To clarify the influence of the learning context and the way in which it interacts with learner characteristics, two organizing concepts are introduced in Chapter 9: instructional press and idiosyncratic drive patterns.

References

Ausubel, D. P. _The Psychology of Meaningful Verbal Learning_. N.Y., Grune & Stratton, 1963.

CHAPTER 9

TWO ORGANIZING CONCEPTS: INSTRUCTIONAL PRESS AND IDIOSYNCRATIC DRIVE PATTERNS

We are ready now to introduce two concepts that seem to impose order upon the significant interactions involving both learner variables and instructor-environment variables. One of these concepts, that of instructional press, leads to predictions about the impact upon students of the particular way in which the instructional environment is managed. The other concept, that of idiosyncratic drive patterns, leads to predictions about the role of particular learner characteristics as partial determinants of the power and impact of specific instructional circumstances. Taken together, the two concepts combine the advantage of parsimony with considerable power to generate predictions congruent with the obtained findings.

Instructional Press

In the discussion of main effects (Chapter 8) we glossed over differences in findings obtained in the three courses with a statement that there was no reason to demand consistency of results across courses. We will now focus upon these differences. We begin by considering discrepancies in the patterns of instruction provided in each of the courses and then develop the concept of instructional press to account for differences in results obtained as a function of the course.

Patterns of Instruction

We have already pointed out superficial similarities between the three courses. They were all televised in somewhat similar fashion, included in the common curriculum, and populated almost exclusively by freshmen and sophomores.

However the courses differed in several important ways. Whereas Zoology and Physiology were true common curriculum options, Educational Psychology was required of all School of Education students. The subject matter in Educational Psychology obviously differed more from that in either of the two other courses than these differed from each other. And the mechanics of course management differed in such uncontrolled respects as number of weekly class meetings, length of each class meeting, requirement of a laboratory, and so on.

Aside from the differences noted above, the courses were dissimilar with respect to the complex factors comprising quality of instruction. The three instructors differed in the adequacy of their lecture pacing, their organization, and their effective utilization of television as an instructional medium. These differences were reflected in the general level of interest maintained by students in the receiving rooms. Judging from discrepancies in the patterns of main effects shown in Tables 8-2 and 8-5, this constellation of uncontrolled course-specific factors led to differences in the dynamics of student acquisition.

In Zoology, acquisition was more sensitive to intrinsic learner conditions than to extrinsic instructor and environmental conditions. Note that end-of-course acquisition was influenced (in the 1961-62 group) by initial level of interest in taking the course (Mot). Note also that acquisition was influenced by educational set and was independent of environmental constraints and manipulations at the level of main effects.

The situation in Physiology was quite different. This instructional environment seemed to typify a denial of undergraduate maturity. The content level of the lectures was low by collegiate standards. Furthermore, the lectures were relatively disorganized and highly repetitive. Students in Physiology behaved accordingly. They expressed much dissatisfaction with the course. The proctors were forced to assume a disciplinary role, and the TV instructor received many complaints from students in unproctored sections indicating a deterioration of morale and a lack of serious academic purpose in these sections. The over-all impression created by the way in which this course was conducted and by student reaction to it, was that acquisition was induced primarily by the necessity for passing the course.

This highly subjective impression was supported at the end of the semester by the main effects shown in Tables 8-2 and 8-5. Note the dependence of acquisition and relevance of thinking upon the presence of the proctor. Note also that acquisition was sensitive to personal contact with the instructor. The picture is one of an instructional setting emphasizing external constraints. Students were "pushed" rather than "encouraged" to learn.

Referring again to the main effects, it appears that the dynamics of acquisition in Educational Psychology were somewhere between the intrinsic emphasis characteristic of Zoology and the extrinsically oriented emphasis in Physiology. Although the intrinsic variables of motivation and educational set did not generate main effects, neither did any of the extrinsic manipulations.

Kinds of Instructional Presses

Discrepancies in the main effects patterns obtained for these three courses reflect differences in what we will hereafter term instructional press. When acquisition is highly dependent upon instructor -environment conditions, as in Physiology, we have evidence for an extrinsic press. When acquisition is particularly dependent upon learner characteristics, as in Zoology, we have evidence for an intrinsic press. Since the situation prevailing in Educational Psychology is somewhere between these two extremes, the press in that course is regarded as mixed.

Our expectations about the differential effects of these instructional presses rested upon our interpretation of their etiology.

Etiology of Instructional Press

There are at least three possible sources of the differences between the main effects patterns in these courses: (a) sampling error, (b) selective factors associated with registration, (c) the way in which the course was conducted.

We have discounted the possibility of sampling error. It seems reasonable to do so because the matrixes of learner variables were identical for the three courses. Thus we were in effect dealing with matched (within the confines of our design) groups of subjects in making comparisons across courses.

The second source, selective factors associated with registration, could have been operating, but we think it unlikely. It is conceivable that since students were free to elect either Physiology or Zoology to fulfill their biological science requirement for graduation, different kinds of students might have chosen one or the other. If this had happened, then the main effects patterns would be interpreted as meaning that the more self-initiated (intrinsically motivated) students were attracted to Zoology whereas the more extrinsically oriented students were attracted to Physiology. The basis for such a selective attraction of students to course options could presumably be the campus "grapevine." Registrants hear from friends that certain courses are easy, others, hard; certain instructors are interesting, others dull; and so on.

Although we did not acquire data for a direct test of this possible selective factor, what evidence we do have indicates that if it operated at all, it was not very powerful. The median scores on the ACT, motivation scale and set scale, all administered to the entire enrollments (critical subjects and other students) in Physiology and Zoology were virtually identical. Thus there were no detectable selective factors operating with respect to these three learner characteristics.

Everything considered, we are inclined to believe that what we have termed instructional press is a real phenomenon rather than an artifact, and results from the way in which the course is conducted. Although this is open to test, we believe at this point that the instructor is a key determinant of whether students will experience an intrinsic or an extrinsic press. The instructor communicates an attitude to his students by such behavior as his enthusiasm for the subject matter, the organization of his lectures, his rapport with the class, and so on, and the students respond accordingly. By his actions in class the instructor implies to his students that he regards them as intellectually mature or immature: i.e., as capable of coping with appropriately difficult subject matter and assuming appropriate responsibility for their own learning, or as requiring an oversimplified presentation and continual supervision in order to learn. An instructor who regards his students as intellectually mature generates an intrinsic instructional press. One who regards his students as intellectually immature generates an extrinsic instructional press.

Hypothesized Effects of Instructional Presses

The significance of instructional press is, of course, that different presses are presumed to be associated with corresponding differences in patterns of significant interactions between the variables under investigation. In predicting the direction and quality of these patterns, we made certain inferences about the way in which instructional presses affect student perceptions about the instructional environment. These inferences were consistent with the way in which we believe the presses originated.

If an intrinsic press results when the instructor behaves as if the students are intellectually mature, then these students ought in turn to emphasize in their perceptions the potentially supportive aspects of the instructional environment. The instructor should be seen by them as helpful rather than punitive, and his examinations as fair rather than unjust.

Conversely, if an extrinsic press results when an instructor behaves as if his students are intellectually immature, these students ought to emphasize in their perceptions the potentially punitive or threatening aspects of the instructional environment.

Thus we hypothesized the operation of instructional press as a differential power factor affecting educational performance. Whereas all instructional environments are potentially supportive and potentially threatening to some students, the former aspect was hypothesized as the more powerful in the context of an intrinsic press and the latter as the more powerful in the context of an extrinsic press.

Hence the following generalization is stated as a first organizing concept:

An extrinsic instructional press sensitizes students to the potentially punitive and threatening (inhibiting) aspects of the instructional environment. An intrinsic instructional press sensitizes students to the potentially supportive (facilitating) aspects of the instructional environment.

Idiosyncratic Drive Patterns

In discussing the main effects (Chapter 8) we distinguished between intrinsically driven learning and learning as a response to such externally directed drives as the desire to be graduated, earn approbation, and so on. The student's several extrinsically directed and intrinsically derived goal orientations all combine in some fashion. This idiosyncratic mix brought by him into the classroom may either be further reinforced by the instructional setting or conflict with the structure and demands of that setting.

This suggests the following generalization as a second organizing concept:

Educational performance is maximized when the instructional setting is congruent with the learner's idiosyncratic drive pattern and minimized when the instructional setting and the learner's idiosyncratic drive pattern are dissonant.

The idiosyncratic drive pattern probably controls educational performance in two ways:

First, it determines the appropriateness or inappropriateness for a particular student of selected aspects of the instructional setting. Obviously, provision of considerable opportunity for personal contact with the instructor, for example, is most appropriate for students needing a nurturant relationship and least appropriate for students not needing such a relationship.

Second, the idiosyncratic drive pattern helps shape the student's perceptions about, and his approach to, the course. We would expect a student who is taking a course merely to fulfill a requirement, for example, to respond to it quite differently from one who enrolls because of a genuine pre-professional commitment to the discipline.

The significance of this generalization about idiosyncratic drive pattern, and hence its value once we probe it, is that it directs our attention to identifying (a) the components of idiosyncratic drive patterns, and (b) specific instructional circumstances that are congruent with or dissonant from these patterns.

In order to identify some of its components, we must take a position on the etiology of idiosyncratic drive patterns. Our view of their origin is that they are the current end products of the student's past history of successes and failures for cognitive attainment. Thus two of our "learner variables" would seem to be key factors in establishing idiosyncratic drive patterns: academic ability and educational set.

Ability-Linked Drive Patterns

In their studies comparing televised with other kinds of instructional settings, Macomber and Siegel (1960) noted that televised classes were differentially effective for low and high ability students. Low ability students tended to learn as much or more in TV as in conventional classes. Furthermore, they held the least unfavorable attitudes toward instructional television. High ability students, on the other hand, both learned more and held more favorable attitudes when they participated in a classroom environment encouraging active discussion rather than passive listening.

This interaction between academic ability and the complex of variables comprising "television" and "discussion oriented" instruction alerted us to the possibility that the dynamics of educational performance might be quite different for high and low ability students. It seemed plausible that performance in a particular setting might reflect the extent to which that setting facilitates or restricts learning and related attitudes as a function of the learner's academic ability.

In this view the essential characteristic of the instructional settings investigated by Macomber and Siegel was not that they were "televised" or "conventional," but that they encouraged or discouraged, permitted or prohibited, different kinds of classroom behavior. And the differential effectiveness of these settings for high and low ability students reflected ability-linked differences in receptivity to different kinds of instructional motivators.

Implications of Educational Histories.--High ability college students have likely experienced an educational history replete with positive reinforcement. Their attempts to learn prior to coming to college have been sufficiently successful by external standards that they have developed a self-image of "academic capability." Thus secure in their capacity for learning, they are relatively free to pick and choose what they wish to learn, and to determine for themselves the amount of effort they wish to devote to particular kinds of acquisition.

The educational histories of low ability college students have undoubtedly been quite different. They have more likely experienced educational failures by external standards. Certainly their academic experiences have taught them that in order to attain a given level of academic performance they must expend greater effort over a longer time than their brighter associates. In consequence their academic self-image is one of relative "incapability."

As a refuge from related feelings of scholastic insecurity, low ability students may seek out and thrive in instructional settings that protect them. Such protection is afforded by easy courses and curricula wherein the learning objectives are well within the range of attainability for them, and by specific classroom settings wherein the perceived risk of personal embarrassment from external forces (e.g., ridicule by peers or the instructor) is minimal.

This rationale accounts for observed differences in the effectiveness of televised and conventional instruction as a function of academic ability. More basically, it suggests a difference in sensitivity to different kinds of motivators by high and low ability students. For high ability college students, the incentives for learning tend primarily to be intrinsically based and only secondarily to be derived from external circumstances. However for low ability students, these incentives are primarily extrinsically based and only secondarily derived from intrinsic conditions.

In short, brighter college students tend to learn to please themselves, and are responsive to the environment only when they have little intrinsic interest in the content. Less bright students, on the other hand, respond to the environment when they are interested in the content and ignore the environment when they have little intrinsic interest in the content.

Predicted Effects of Ability-Linked Drive Patterns.--The above rationale suggests that there is a second order interaction between academic ability, intrinsically based motivation, and extrinsically generated drive. This interaction is derived from a difference in the way intrinsic motivation sensitizes students of varying ability levels to extrinsic circumstances.

For the present discussion we will designate the extrinsic circumstances simply as "facilitators" and "inhibitors" of performance. Extrinsic facilitators are those features of the instructional setting tending to encourage academic productivity. Extrinsic inhibitors are those features of the instructional setting tending to discourage such productivity. The nature of facilitating and inhibiting conditions was partially clarified in Chapter 8 and will be further elaborated in Chapters 10 and 11.

The predicted effects of ability-linked drive patterns are as follows:

Prediction 1A. Given a high level of intrinsic motivation, low ability students will be more sensitive to extrinsic facilitators and inhibitors than will high ability students.

Prediction 1B. Given a low level of intrinsic motivation, low ability students will be relatively insensitive to extrinsic conditions whereas the performance of high ability students will reflect the operation of these extrinsic facilitators and inhibitors.

It is evident that this pair of predictions concerns the responsiveness to the instructional environment of students with four different ability-linked drive patterns. These patterns are

a. High intrinsic motivation combined with high academic ability;
b. High intrinsic motivation combined with low academic ability;
c. Low intrinsic motivation combined with high academic ability;
d. Low intrinsic motivation combined with low academic ability.

The predictions for each pattern are summarized in Figure 9-1. In this figure, the notations M_h and M_l denote respectively anticipated performance at the mean levels of the high and low ability subgroups; the notations $>$ and $<$ denote respectively anticipated performance above and below a subgroup mean.

Figure 9-1
Performance Predicted as a Function of Ability-Linked Drive Patterns

Level of Intrinsic Motivation	Character of Extrinsic Condition	Performance by	
		High Ability Students	Low Ability Students
High	Facilitating	M_h	$>M_l$
	Inhibiting	M_h	$<M_l$
Low	Facilitating	$>M_h$	M_l
	Inhibiting	$<M_h$	M_l

Set-Linked Drive Patterns

The foregoing discussion concerned our expectations about the influence of a particular idiosyncratic drive pattern: i.e., that related to the learner's academic ability. There are undoubtedly many idiosyncratic drive patterns, each a function of particular learner variables, and all of which interact with one another. A second such pattern about which we made predictions was the one related to educational set.

The nature and assessment of educational set was described in Chapter 4. We made a case there for our expectation that performance by conceptually set students would be superior to that of factually set students. This expectation was supported in a general way by the main effects for educational set and the interactions between this and other learner variables as discussed in Chapter 8.

Implications of Pre-School Histories.--By the time a student is an undergraduate, his educational set can be assessed reliably indicating that this is a stable rather than a transitory characteristic. His predisposition for learning conceptually oriented content, factually oriented content, or a content mix between these extremes is a "given" with which he enters a course.

How and when does his educational set develop?

A case could be made for the influence of his scholastic experiences in interaction with his academic ability level. If we assume that learning to conceptualize is more difficult than factual acquisition by rote, it follows that the former requires a higher level of intellectual ability. Presumably, then, high ability students should develop conceptual sets because they are more consistently reinforced in school than low ability students for conceptual learning. By the same logic, low ability students ought to develop a set away from conceptual learning (and perhaps toward factual acquisition).

This argument implies the existence of at least a moderately high correlation between educational set and academic ability--an implication not corroborated by our data. We characteristically find that the correlation between these two variables is between .20 and .25.

Therefore, although we believe that a student's educational set reflects the learning orientation for which he has been most consistently reinforced, we speculate that educational set is established even more by pre-school than in-school experiences. In particular, we think now that youngsters acquire these sets while they are still quite young, primarily from their parents. The way in which a parent consistently responds to his child's inquiries about his ever-expanding world, and the intellectual directions encouraged or discouraged by the parent, are critical determinants of the set developed by the youngster. Although sheer speculation, this suspected origin of educational set can easily be tested. We anticipate, for example, that there is a strong correlation both between the sets held by parents and their children, and those held by siblings raised together.

Regardless of the developmental schedule for educational set--either in school or prior to school--it seems reasonable to hold to the mechanism of reinforcement as the vehicle for its development. If a youngster is reinforced for conceptual thinking with sufficient consistency and frequency, he likely will develop a preference for this kind of intellectual endeavor. Conversely, if he is reinforced for factual acquisition with sufficient consistency and frequency, he likely will develop a preference for *this* kind of intellectual endeavor.

Predicted Effects of Set-Linked Drive Patterns.--As discussed in Chapter 8, the principle of *subsumption* was central to our predictions about the effects of various kinds of educational set. This principle led us to predict that, other things being equal, conceptually set students would be more likely than factually set students to learn *both* conceptually and factually oriented content.

This expectation is the analog of a parallel expectation for the variable "academic ability": i.e., other things being equal, high ability students will be more likely than low ability students to learn both conceptually and factually oriented content.

However, as with our discussion of ability-linked drive patterns, we regarded the "other things being equal" prediction about educational set as an oversimplification because it neglects two critical components of the instructional gestalt: i.e., intrinsically based motivation, and extrinsically generated drive.

Intrinsically based motivation is characterized in our design as being "high" (favorable pre-course attitudes) or "low" (unfavorable pre-course attitudes). For the present, we will characterize the extrinsic circumstances potentially capable of generating drive simply as "facilitators" or "inhibitors" of performance. The nature of these facilitators and inhibitors will be elaborated in Chapter 11.

The predicted effects of set-linked drive patterns are as follows:

Prediction 2A. Given a *high* level of intrinsic motivation, both factually and conceptually set students will be sensitive to extrinsic facilitators and inhibitors.

Prediction 2B. Given a *low* level of intrinsic motivation, neither *factually nor* conceptually set students will be sensitive to extrinsic facilitators and inhibitors.

This pair of predictions about the effect of set-linked drive is summarized in *Figure 9-2*. In this figure, the notations M_c and M_f denote respectively anticipated performance at the mean levels of the conceptually and factually set subgroups; the notations $>$ and $<$ denote respectively anticipated performance above and below a subgroup mean.

Figure 9-2
Performance Predicted as a Function of Set-Linked Drive Patterns

Level of Intrinsic Motivation	Character of Extrinsic Condition	Performance by	
		Conceptually Set Students	Factually Set Students
High	Facilitating	$> M_c$	$> M_f$
	Inhibiting	$< M_c$	$< M_f$
Low	Facilitating	M_c	M_f
	Inhibiting	M_c	M_f

Summary

Thus far, we have discussed two major idiosyncratic drive patterns in a preliminary fashion. One of these is a function of the student's academic ability; the other is a function of his educational set. We believe these patterns are brought into the classroom by the student and affect his responses to specific features of the instructional setting.

The discussion of these drive patterns and their anticipated influence as thus far presented is incomplete in two respects:

First, it has been convenient in Figures 9-1 and 9-2 to designate extrinsic conditions as "facilitators" and "inhibitors" without attempting further to specify the nature of facilitating and inhibiting instructional conditions. Second, both types of idiosyncratic drive patterns have thus far been discussed without involving the concept of instructional press, and without concern for the way in which different instructional presses interact with idiosyncratic drive patterns to determine performance levels. Both of these matters are discussed in Chapters 10 and 11.

CHAPTER 10

EXTRINSIC FACILITATORS AND INHIBITORS OF ABILITY-LINKED DRIVE PATTERNS

The preceding chapter introduced two conceptual generalizations which we believe impose a high degree of order upon many of our findings. These are reiterated below:

1. The way in which the course is conducted imposes a uniform instructional press upon all students. These presses were characterized as "extrinsic", "intrinsic", and "mixed". An extrinsic instructional press sensitizes students to the potentially punitive, threatening, or inhibiting features of the instructional environment. An intrinsic instructional press sensitizes students to the potentially supportive or facilitating aspects of the instructional environment.

To aid in testing and using this concept, we concluded from the patterns of main effects that the instructional press in Physiology was somewhere near the extrinsic pole of the hypothesized continuum, that in Zoology was somewhere near the intrinsic pole of the hypothesized continuum, and that in Educational Psychology was "mixed" (near the middle of the hypothesized continuum.)

2. Whether or not a particular instructional circumstance or combination of circumstances will facilitate or inhibit performance by particular learners depends upon the learner's idiosyncratic drive pattern. This pattern may be a function of several organismic characteristics, two of which were regarded in the previous chapter as especially important: academic ability, and educational set.

Thus whereas the learner's idiosyncratic drive pattern determines whether a given instructional circumstance has potential for facilitating or inhibiting his performance, the instructional press prevailing in the class determines whether or not he will be sensitive to such facilitation or inhibition of performance.

In this chapter, we consider one kind of idiosyncratic drive pattern: i.e., that pattern which is a function of academic ability. We will formulate two general hypotheses about instructional circumstances potentially facilitating and inhibiting performance as a function of academic ability, and discuss the relevant data.

Chapter 11 is given to a parallel discussion for a second kind of idiosyncratic drive pattern: i.e., that pattern which is a function of educational set.

Hypotheses

The two hypotheses below posit quite different interactions between instructor-environment conditions and academic ability as a function of the latter. The central notions in the case of low ability students are their desire to avoid intellectual threat and to receive academic guidance. The central notion in the case of high ability students is their search for an environment providing them with an appropriate intellectual challenge.

This hypothesized difference in orientation to the instructional environment as a function of academic ability results from what we have previously (in Chapter 9) described as ability-linked patterns of reinforcement provided throughout the student's educational history.

Hypothesis I. (Low Ability Students)

A facilitating learning environment for low ability students (a) reduces their perceptions of the likelihood of failure and/or (b) directs their attention to the materials to be learned.

The converse of these conditions was hypothesized to inhibit the performance of low ability students. Thus their performance was expected to be adversely affected by circumstances increasing their perception of the likelihood of failure and/or directing their attention away from the content to be learned.

Hypothesis II. (High Ability Students)

The most effective (i.e., facilitating) learning environment for high ability students will be the one providing an intellectual challenge appropriate to their level of ability.

The converse of these conditions (i.e., inappropriately easy or intellectually unchallenging circumstances) was expected adversely to affect the performance of high ability students.

Predictions

The design for these courses included three instructor-environment variables with two conditions for each:

1. Personal contact with the instructor - Some opportunity for contact vs. no opportunity for contact.
2. Manifest objective - Manifest conceptual objective vs. manifest factual objective.
3. Proctor - Presence of a proctor vs. absence of a proctor.

We will consider each of these variables, and its constituent conditions, as a potential facilitator or inhibitor of performance for students of high and low academic ability.

Personal Contact (Con)

In considering personal contact with the instructor as a variable, we must distinguish between the amount and nature of such contact.

The amount of contact depends upon such circumstances as the length of instructor's scheduled office hours, his availability to students for personal conferences, and (in televised courses) the amount of time he actually spends in face-to-face appearances before the class. Since these conditions are relatively easy to control empirically, they are often used to distinguish "contact" from "no contact" conditions for research purposes. The comparison between these conditions usually leads to the conclusion that contact is a relatively unimportant aspect of the instructional setting.

Two Kinds of Contact.--The hypotheses stated above lead us to regard personal contact with the instructor in class as a mixed blessing. The value and effects of such contact depends upon the nature of the personal contact and the way in which it is perceived by the student. At the risk of oversimplification, it is convenient to distinguish two quite different postures that the instructor may assume when he interacts with students in class. He may use this interaction as an opportunity to clarify previously covered content; or he may use it as an opportunity further to explore previously covered content.

Clarification is particularly appropriate for low ability students. These are the students most likely to have experienced difficulty in understanding what has transpired during the lecture, and therefore to require further elaboration of the basic lecture content. High ability students do not require such clarification of content already presented, and probably regard it as repetitious and boring as well as unnecessary.

Further exploration, on the other hand, is particularly appropriate for high ability students and often inappropriate for those of low ability. Low ability students are not ready to explore the content further in a discussion because there are usually large portions of it that they have not yet assimilated.

Ability x Personal Contact.--Hypotheses I and II specify different performance outcomes as a dual function of academic ability and the type of personal contact provided during class discussions.

Discussion designed to clarify the lecture content should facilitate performance by low ability students (Hypothesis I). Since high ability students probably regard this type of contact as contributing to an inappropriately easy instructional condition, their performance may be adversely affected by it (Hypothesis II).

When, on the other hand, the instructor uses the opportunity for contact with his students further to explore the lecture content previously presented, he is creating an additional intellectual challenge for the high ability students and generating a potential threat for low ability students. Hypotheses I and II predict that exploratory contact will facilitate performance by high ability students and cause a performance deterioration by low ability students.

These predictions are summarized in Figure 10-1A.

Intra-Course Differences in Contact.--As described in Chapter 5, there were important differences in the way in which the contact condition was effected in the three courses here considered, and in what transpired during the contacts between students and instructors.

The amount of weekly contact between the instructor and selected groups of students was about two hours in Zoology, 50 minutes in Educational Psychology, and about 15 minutes in Physiology. The contact activity also varied: In Zoology, the instructor conducted a weekly laboratory essentially duplicating the content that had been covered in lecture that week. The purpose of the laboratory was further to clarify the lecture content. Students in the no-contact condition of this course attended other sections of the laboratory taught by persons other than the TV lecturer. The contact activity in Educational Psychology was a post-lecture discussion period led by the TV instructor. During these discussions he attempted to encourage the students to think about applications of the lecture content and to explore it further. Students in the no-contact condition of this course attended post-lecture discussions conducted by graduate assistants. In Physiology, the relatively brief periods of contact with the instructor were given to simple question-and -answer sessions handled by the TV instructor.

Thus, although we cannot offer evidence on this point, we feel that the contact between students and instructor in Zoology was primarily of the type we have characterized as "clarificatory" whereas that in Educational Psychology was primarily of the type we have characterized as "exploratory." The anticipated Contact x Ability interaction without regard for instructional press and ability-linked drive patterns are thus shown in Figure 10-1A.1 for Zoology and in Figure 10-1A.2 for Educational Psychology. Because of the brevity of contact opportunities in Physiology, we expected that the opportunity for contact with the instructor would exert no systematic effects upon performance in this particular course. As we observed earlier (Table 5-1), students in the contact condition of this course felt they were less well known to the instructor than did students in the contact conditions of the two other courses.

Instructional Press x Ability x Personal Contact.--Figure 9-1 summarized, in a general way, our predictions about performance levels anticipated as a function of instructional press and ability-linked drive patterns. For those predictions, the instructor-environment conditions were characterized simply as "facilitators" or "inhibitors."

Having specified combinations of circumstances where personal contact or its absence is hypothesized as a "facilitator" or "inhibitor"

Figure 10-1

Anticipated Facilitating and Inhibiting Effects of Personal Contact*

A. Ability x Personal Contact

1. Contact Clarifies Lecture Content

Contact Condition	Effect Upon Performance By High Ability Students	Effect Upon Performance By Low Ability Students
Contact	Inhibit ($<M_H$)	Facilitate ($>M_L$)
No Contact	Facilitate ($>M_H$)	Inhibit ($<M_L$)

2. Contact Explores Beyond Lecture Content

Contact Condition	Effect Upon Performance By High Ability Students	Effect Upon Performance By Low Ability Students
Contact	Facilitate ($>M_H$)	Inhibit ($<M_L$)
No Contact	Inhibit ($<M_H$)	Facilitate ($>M_L$)

B. Ability-Linked Drive Pattern x Instructional Press x Ability x Personal Contact

Instructional Press (and Course)	Nature of Contact	Pre-Course Attitude	Contact Condition	Ability Level: High Ability	Ability Level: Low Ability
Intrinsic (Zoology)	Clarificatory	High Mot	Con	M_H	$>M_L$
			No Con	M_H	M_L
		Low Mot	Con	M_H	M_L
			No Con	$>M_H$	M_L
Extrinsic (Physiology)	Ineffective	High Mot	Con	M_H	M_L
			No Con	M_H	M_L
		Low Mot	Con	M_H	M_L
			No Con	M_H	M_L
Mixed (Ed. Psychol.)	Exploratory	High Mot	Con	M_H	$\not>M_L$
			No Con	M_H	$\not<M_L$
		Low Mot	Con	$\not>M_H$	M_L
			No Con	$\not<M_H$	M_L

* M_H and M_L are means of high and low ability subgroups; $>$ denotes anticipated performance considerably above a subgroup mean, and $<$ considerably below a subgroup mean; $\not>$ & $\not<$ denote anticipated performance slightly above and below a subgroup mean.

in Figure 10-1A, it is now possible further to refine these predictions. These refined predictions, which are summarized in Figure 10-1B, take into account our statements in Chapter 9 about the hypothesized interaction between the instructional press, ability-linked drive, and personal contact.

Manifest Objective (O)

By design, the instructor selectively emphasized factual or conceptual acquisition by means of the three hourly examinations he administered during the semester. The content differences between the factual and conceptual forms of each examination will be discussed in Chapter 11 as especially important considerations in making predictions as a function of set-linked drive. For the present discussion of ability -linked drive, we are more interested in differences in difficulty of the two forms of each examination because of these content differences than we are in the matter of content *per se*.

Ability x Manifest Objective.--The conceptual form of each examination was uniformly more difficult than the factual form of that examination. Therefore, from Hypothesis II we predicted that the performance of high ability students would be enhanced under the manifest conceptual condition because of the greater intellectual challenge provided by it. From Hypothesis I we predicted that the manifest factual condition would be especially facilitating to low ability students because of the threat inherent in the difficulty of the conceptual form.

The predicted Ability x Manifest Objective interactions are shown in Figure 10-2A.

Instructional Press x Ability x Manifest Objective.--As with all instructor-environment variables, we anticipated that the impact of the manifest objective conditions would be affected by the prevailing instructional press as well as by the student's ability-linked drive pattern.

Figure 10-2B summarizes our expectations about performance in each course taking into account the differences in instructional presses operating in these three courses.

These predictions are further refined in Figure 10-2C by taking into account the ability-linked drive patterns associated with the various combinations of the variables "academic ability" and "motivation."

Proctor (Pr)

The duties of the proctor in Zoology and Physiology were limited to checking attendance and maintaining discipline during the TV lectures. In addition to these duties, some of the proctors in Educational Psychology conducted a discussion following each lecture in that course.

Ability x Proctor.--Since the proctor's primary function was to make it possible for interested students to attend to the lecture without undue distractions from disinterested classmates, we expected that his

Figure 10-2

Anticipated Facilitating and Inhibiting Effects of Manifest Objective*

A. Ability x Manifest Objective

Manifest Objective	Ability Level High Ab	 Low Ab
Conceptual	Facilitate ($>M_H$)	Inhibit ($<M_L$)
Factual	Inhibit ($<M_H$)	Facilitate ($>M_L$)

B. Instructional Press x Ability x Manifest Objective

Instructional Press (and Course)	Manifest Objective	Ability Level High Ab	 Low Ab
Intrinsic (Zoology)	Conceptual	Facilitate ($>M_H$)	No Effect (M_L)
	Factual	Inhibit ($<M_H$)	No Effect (M_L)
Extrinsic (Physiology)	Conceptual	No Effect (M_H)	Inhibit ($<M_L$)
	Factual	No Effect (M_H)	Facilitate ($>M_L$)
Mixed (Educ. Psychol.)	Conceptual	Mild Facil. ($\gtrdot M_H$)	Mild Inhib. ($\lessdot M_L$)
	Factual	Mild Inhib. ($\lessdot M_H$)	Mild Facil. ($\gtrdot M_L$)

C. Ability-Linked Drive Pattern x Instructional Press x Ability x Manifest Objective

Instructional Press (and Course)	Pre-Course Attitude	Manifest Objective	Ability Level High Ab	 Low Ab
Intrinsic (Zoology)	High Mot	Conceptual	M_H	M_L
		Factual	M_H	$>M_L$
	Low Mot	Conceptual	$>M_H$	M_L
		Factual	M_H	M_L
Extrinsic (Physiology)	High Mot	Conceptual	M_H	$<M_L$
		Factual	M_H	M_L
	Low Mot	Conceptual	M_H	M_L
		Factual	$<M_H$	M_L
Mixed (Educ. Psychol.)	High Mot	Conceptual	M_H	$\lessdot M_L$
		Factual	M_H	$\gtrdot M_L$
	Low Mot	Conceptual	$\gtrdot M_H$	M_L
		Factual	$\lessdot M_H$	M_L

* M_H and M_L are means of high and low ability subgroups; $>$ denotes anticipated performance considerably above a subgroup mean, and $<$ considerably below a subgroup mean; $\gtrdot$ & $\lessdot$ denote anticipated performance slightly above and below a subgroup mean.

presence would facilitate performance by both high and low ability students. Similarly, we expected that the absence of a proctor would depress performance by both ability subgroups. In other words, as shown in Figure 10-3A, there was no reason to anticipate a significant Ability x Proctor interaction.

Instructional Press x Ability x Proctor.--Figure 10-3B summarizes the predictions for each course taking into account the differences in instructional presses operating in these three courses. The facilitating effect of the proctor's presence is accentuated in Zoology; the inhibiting effect of the absence of any proctor is accentuated in Physiology.

These predictions are further refined in Figure 10-3C by taking into account the ability-linked drive patterns associated with the various combinations of the variables "academic ability" and "motivation."

Results

Figures 10-1, 10-2, and 10-3 summarized the predictions about performance derived from the concepts "instructional press" and "ability-linked drive." In particular, these figures predict performance patterns for 3 first-order interactions (Ab x Con, Ab x O, and Ab x Pr) and 3 second-order interactions (Mot x Ab x Con, Mot x Ab x O, and Mot x Ab x Pr).

Although these figures show the predicted directions of performance by each subgroup, they provide only very gross indications of the anticipated magnitudes of the elevation or depression of any subgroup mean. Hence, they indicate which interactions are most likely not to be statistically significant and which ones have the greatest potential for showing statistical significance. Although the figures are not intended to predict specific interactions that will be statistically significant, they do predict that certain combinations of variables will elevate or depress performance and direct our attention to these combinations if the interaction is, in fact, significant.

To illustrate, consider the performance pattern predicted for Mot x Con x Ab in Zoology (Figure 10-1B). The figure indicates the possibility of a statistically significant interaction in this instance. Whether or not this interaction is actually found to be statistically significant depends upon the strength of the anticipated facilitating effect of personal contact for highly motivated, low ability students. If this effect is weak, the interaction cannot be statistically significant. If, on the other hand, the interaction is significant, the rationale thus far presented leads us to anticipate that it will be so because performance is facilitated in this particular subgroup.

The empirical data to be compared with the predicted performance patterns (Figures 10-1, 10-2, 10-3) are summarized in Table 10-1. This table is extrapolated from Tables 7-1 and 7-2, and shows the mean squares for all main effects, and the six interactions predicted by the rationale thus far presented. Subgroup means for the statistically significant interactions noted in Table 10-1 are cited in Table 10-2.

Figure 10-3

Anticipated Facilitating and Inhibiting Effects of Proctor*

A. Ability x Proctor

	Ability Level	
Proctor Condition	High Ab	Low Ab
Proctor	Facilitate ($>M_H$)	Facilitate ($>M_L$)
No Proctor	Inhibit ($<M_H$)	Inhibit ($<M_L$)

B. Instructional Press x Ability x Proctor

		Ability Level	
Instructional Press (and Course)	Proctor Condition	High Ab	Low Ab
Intrinsic (Zoology)	Proctor	Facilitate ($>M_H$)	Facilitate ($>M_L$)
	No Proctor	No Effect (M_H)	No Effect (M_L)
Extrinsic (Physiology)	Proctor	No Effect (M_H)	No Effect (M_L)
	No Proctor	Inhibit ($<M_H$)	Inhibit ($<M_L$)
Mixed (Ed. Psychol.)	Proctor	Mild Facil. ($\succ M_H$)	Mild Facil. ($\succ M_L$)
	No Proctor	Mild Inhib. ($\prec M_H$)	Mild Inhib. ($\prec M_L$)

C. Ideosyncratic Drive Pattern x Instructional Press x Ability x Proctor

			Ability Level	
Instructional Press (and Course)	Pre-Course Attitude	Proctor Condition	High Ab	Low Ab
Intrinsic (Zoology)	High Mot	Proctor	M_H	$>M_L$
		No Proctor	M_H	M_L
	Low Mot	Proctor	$>M_H$	M_L
		No Proctor	M_H	M_L
Extrinsic (Physiology)	High Mot	Proctor	M_H	M_L
		No Proctor	M_H	$<M_L$
	Low Mot	Proctor	M_H	M_L
		No Proctor	$<M_H$	M_L
Mixed (Ed. Psychol.)	High Mot	Proctor	M_H	$\succ M_L$
		No Proctor	M_H	$\prec M_L$
	Low Mot	Proctor	$\succ M_H$	M_L
		No Proctor	$\prec M_H$	M_L

* M_H and M_L are means of high and low ability subgroups; $>$ denotes performance considerably above, $\succ$ slightly above, $<$ considerably below and $\prec$ slightly below a subgroup mean.

Table 10-1

Analysis of Variance Summary: Selected Interactions Involving Academic Ability

Source	Educational Psychology						Zoology (61-62)						Zoology (62-63)						Physiology					
	Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance	
	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p
Proctor (Pr)	28		0		13		30		4		81		30		8		1		1785	.01	262	.01	1029	.01
Manifest Objective (O)	18		3		32		6		37		45		34		3		173	.10	313		9		4	
Personal Contact (Con)	2		9		694	.01	32		2		428	.01	5		44		126		1105	.01	71		33	
Academic Ability (Ab)	1876	.01	2329	.01	553	.05	1081	.01	1146	.01	1		1313	.01	1660	.01	111		2720	.01	591	.01	0	
Motivation (Mot)	32		15		140		316	.05	273	.05	58		17		3		126		11		0		1	
Educational Set (S)	91		36		113		316	.05	439	.05	6		300	.05	341	.01	46		253		33		424	.01
Prior Knowledge (PK)	587	.01	205	.01	63		61		189	.10	6		98		389	.01	0		6		256	.01	183	xx
Pr x Ab	0		1		28		36		1		38		63		17		138		43		14		111	
O x Ab	20		7		13		88		3		41		5		25		6		6		1		29	
Con x Ab	313	.01	38		63		53		65		14		162	.10	27		345	.05	18		13		9	
Mot x Pr x Ab	0		2		66		270	xx	188	xx	595	.01	26		6		35		751	.05	11		74	
Mot x O x Ab	109		2		15		128		297	.05	11		34		107	.05	70		26		22		0	
Mot x Con x Ab	32		0		38		72		8		61		0		122	.10	25		181		4		12	
Error MS	40.79		26.64		74.09		75.50		64.66		45.39		54.18		35.37		56.97		115.81		25.90		51.21	

x df = 1 always; MS and SS are identical

xx $p < .10$ but not regarded as significant

Table 10-2

Subgroup Means for Significant Interactions Noted in Table 10-1

Interaction	Course	Criterion	p	Interacting Variables		Ability	
						High Ab	Low Ab
Con x Ab	Ed. Psychol.	Factual	.01		Con	57.25	46.46
					No Con	54.34	49.81
	Zoo. 62-63	Factual	.10		Con	34.83	30.66
					No Con	36.69	28.03
	Zoo. 62-63	Relevance	.05		Con	17.06	18.44
					No Con	18.31	13.22
Mot x Con x Ab	Zoo. 62-63	Conceptual	.10	High Mot	Con	29.31	26.31
					No Con	30.88	22.13
				Low Mot	Con	32.75	23.19
					No Con	30.69	23.19
Mot x O x Ab	Zoo. 61-62	Conceptual	.05	High Mot	Conceptual O	34.31	29.69
					Factual O	34.69	25.75
				Low Mot	Conceptual O	32.94	23.81
					Factual O	28.63	27.38
	Zoo. 62-63	Conceptual	.05	High Mot	Conceptual O	29.44	25.81
					Factual O	30.75	22.63
				Low Mot	Conceptual O	32.25	22.31
					Factual O	31.19	24.06
Mot x Pr x Ab	Physiology	Factual	.05	High Mot	Pr	78.31	71.43
					No Pr	72.93	58.68
				Low Mot	Pr	80.81	66.93
					No Pr	68.93	67.06
	Zoo. 61-62	Relevance	.01	High Mot	Pr	19.20	23.72
					No Pr	24.64	22.67
				Low Mot	Pr	23.87	17.50
					No Pr	19.62	24.00

Discussion

Table 10-3 shows the correspondence between the predicted and obtained performance patterns for the several subgroups under consideration. Three illustrations will suffice to indicate the way in which this table is to be read.

The first row, for example, concerns the Con x Ab interaction in Zoology (61-62). With respect to statistical significance, the rationale led us to predict (in Figure 10-1A.1) the possibility of a significant F-ratio. However since the results obtained for the three criteria failed of statistical significance, the predicted performance pattern could not be verified.

The second row concerns the same interaction but for Zoology (62-63). In this course, the obtained results for two of the criteria (factual acquisition and relevance of thinking) were statistically significant. And the performance patterns obtained conformed in both instances to the appropriate prediction in Figure 10-1A.1.

The third row again concerns the Con x Ab interaction, but for Physiology. Because of the brevity of contact opportunities in this course, we had predicted that the personal contact condition would be ineffective and therefore that there would not be a significant Con x Ab interaction. The relevant findings failed of significance for all criteria; hence these predictions were confirmed.

All together, Table 10-3 compares predictions with findings for 72 F-ratios (6 sources in 4 courses with 3 criteria for each). Of this number, 27 F-ratios were predicted to fail of statistical significance and 45 F-ratios were predicted as possibly (but not necessarily) significant.

For the 27 F-ratios predicted not to be statistically significant, the predictions were confirmed in all instances. Eight of the remaining 45 variable combinations generated significant F-ratios with subgroup performance patterns conforming either very closely or partially to those predicted from the rationale thus far presented.

Summary

This chapter concerned a particular component of the student's idiosyncratic drive pattern: i.e., that component associated with his level of academic ability. We took for granted the fact that high ability students are capable of better academic performance than low ability students. However we demonstrated that performance differentials associated with ability differences could be enhanced or diminished by specific features of the instructional environment. Thus ability is an organismic variable which interacts with the instructional environment jointly to determine performance.

Two organizing concepts helped us understand this interaction. First we posited the existence of ability-linked drive patterns resulting

Table 10-3

Summary of Anticipated and Obtained Effects

Source	Course	Statistical Significance				Performance Patterns			
		Prediction	Result Obtained			Prediction	Agreement between Prediction & Result		
			Factual	Conceptual	Relevance		Factual	Conceptual	Relevance
Con x Ab	Zoology (61-62)	Possible	ns	ns	ns	Per Fig. 10-1A.1	-	-	-
	Zoology (62-63)	Possible	.10	ns	.05	Per Fig. 10-1A.1	Yes	-	Yes
	Physiology	ns	ns	ns	ns	No interaction	Yes	Yes	Yes
	Educ. Psychol.	Possible	.01	ns	ns	Per Fig. 10-1A.2	Yes	Yes	Yes
Mot x Con x Ab	Zoology (61-62)	Possible	ns	ns	ns	Per Fig. 10-1C	-	-	-
	Zoology (62-63)	Possible	ns	.10	ns	Per Fig. 10-1C	-	Low Ab only	-
	Physiology	ns	ns	ns	ns	Per Fig. 10-1C	Yes	Yes	Yes
	Educ. Psychol.	Unlikely	ns	ns	ns	Per Fig. 10-1C	Yes	Yes	Yes
O x Ab	Zoology (61-62)	Possible	ns	ns	ns	Per Fig. 10-2B	-	-	-
	Zoology (62-63)	Possible	ns	ns	ns	Per Fig. 10-2B	-	-	-
	Physiology	Possible	ns	ns	ns	Per Fig. 10-2B	-	-	-
	Educ. Psychol.	Unlikely	ns	ns	ns	Per Fig. 10-2B	Yes	Yes	Yes
Mot x O x Ab	Zoology (61-62)	Possible	ns	.05	ns	Per Fig. 10-2C	-	High Ab only	-
	Zoology (62-63)	Possible	ns	.05	ns	Per Fig. 10-2C	-	High Ab only	-
	Physiology	Possible	ns	ns	ns	Per Fig. 10-2C	-	-	-
	Educ. Psychol.	Unlikely	ns	ns	ns	Per Fig. 10-2C	Yes	Yes	Yes
Pr x Ab	Zoology (61-62)	ns	ns	ns	ns	Per Fig. 10-3B	Yes	Yes	Yes
	Zoology (62-63)	ns	ns	ns	ns	Per Fig. 10-3B	Yes	Yes	Yes
	Physiology	ns	ns	ns	ns	Per Fig. 10-3B	Yes	Yes	Yes
	Educ. Psychol.	ns	ns	ns	ns	Per Fig. 10-3B	Yes	Yes	Yes
Mot x Pr x Ab	Zoology (61-62)	Possible	xx	xx	.01	Per Fig. 10-3C	-	-	High Ab only
	Zoology (62-63)	Possible	ns	ns	ns	Per Fig. 10-3C	-	-	-
	Physiology	Possible	.05	ns	ns	Per Fig. 10-3C	Yes	-	-
	Educ. Psychol.	Possible	ns	ns	ns	Per Fig. 10-3C	-	-	-

xx $p < .10$ but not regarded as statistically significant from differences in the academic histories of high and low ability students, and predisposing specific features of the instructional environment to be potential performance "facilitators" or "inhibitors."

Second, we posited instructional press as a "wash" over the interaction between organismic characteristics and environmental conditions. Potentially facilitating circumstances (learner characteristics and environmental conditions) are likely, in fact, to facilitate performance when the instructional press is intrinsic. Similarly, the potentially inhibiting learner characteristics and aspects of the environment are more likely, in fact, to inhibit performance when the instructional press is extrinsic.

Thus whereas academic performance is potentially maximized for high ability students placed in an intellectually challenging environment, this potential effect is most evident when the instructional press is intrinsic and least evident when the instructional press is extrinsic.

Likewise, whereas academic performance is potentially minimized for low ability students in a threatening or intellectually embarrassing environment, this potential effect is most evident when the instructional press is extrinsic and least evident when the instructional press is intrinsic.

CHAPTER 11

EXTRINSIC FACILITATORS AND INHIBITORS OF SET-LINKED DRIVE PATTERNS

The present chapter parallels the preceding one except that we are here concerned with performance patterns associated with educational set rather than with academic ability. This set has already been defined as a predisposition by the student to learn factual content, conceptual content, or some mixture of these two types of content.

The similarity between academic ability and educational set as organismic variables is that a particular condition of each favors educational performance. Other things being equal, high ability students perform better than low ability students, and (as we have demonstrated in Chapter 8), conceptually set students perform better than factually set students. However it is important to emphasize that the correlation between ability and set is relatively low (about .25). Thus it would be incorrect to equate high ability with conceptual set and low ability with factual set.

Hypotheses

We entered the interpretation of data concerning educational set and its interaction with other aspects of the instructional gestalt with two basic hypotheses. One of these (Hypothesis III) concerned the role of set independent of other learner characteristics and environmental circumstances. The other (Hypothesis IV) concerned the interaction of set with that aspect of the instructional environment which we have designated "manifest objective."

Hypothesis III: Main Effect of Set

Other things being equal, conceptually set students will be more likely than factually set students to learn both conceptually oriented content (e.g., principles, generalizations, applications) and factually oriented content. This hypothesis, and the evidence supporting it, was discussed in Chapter 8.

Hypothesis IV: Set x Manifest Objective

Of the three instructor-environment conditions manipulated in this design (personal contact, proctor, and manifest objective) only the variable manifest objective seemed *a priori* to be appropriate to performance as a function of set-linked drive.

With regard to the manifest objective variable, we have already clarified the design enabling instructors to reward selected students for learning either factual or conceptual content. The type of acquisition rewarded by him was manipulated by controlled administration throughout the semester of one or the other kind of hourly examinations. The orientations of these examinations manifested either a conceptual or a factual instructional objective to the students.

Thus we hypothesized that conceptually set students would perform best when consistently reinforced for conceptual acquisition (the manifest conceptual objective condition) and factually set students would perform best when consistently reinforced for factual acquisition (the manifest factual objective condition).

Predictions

Main Effect and Set x Manifest Objective

The prediction following from Hypothesis III is summarized in Figure 11-1A; that following from Hypothesis IV is summarized in Figure 11-1B. For simplicity these predictions have been stipulated with reference to the mean of the total group for Hypothesis III, and with reference to the means of the conceptually and factually set subgroups for Hypothesis IV.

The predictions in Figure 11-1A and Figure 11-1B reflect what we have termed idiosyncratic drive pattern (in these instances, set-linked drive patterns). They are further refined in the ensuing section by adding to them the influence attributable to the instructional press prevailing in each course.

Instructional Press x Set x Manifest Objective

You will recall that we characterized polar instructional presses as "extrinsic" and "intrinsic." The former, characteristic of Physiology, is centrally structured about an externally applied system of reinforcements. The latter, characteristic of Zoology, emphasizes intrinsic reinforcements: i.e., the students learn to please themselves as well as the instructor and the demands imposed by the educational context. Since educational set is an intrinsic condition, its operation in the fashion proposed by Hypothesis III could either be facilitated or inhibited by the prevailing instructional press.

Given an intrinsic press, we expected the hypothesized superiority of conceptual set to hold regardless of the instructor's manifest objective. Since this press renders students relatively insensitive to potential performance inhibitors provided by the learning environment, Hypothesis IV is not applicable under this circumstance.

However, when the instructional press is extrinsic (as in Physiology) it is reasonable to expect students to look to the instructor for some tangible indication of what they should learn. The instructor in our design provided such an indication by the objective he manifested. Hence Hypothesis IV is particularly appropriate to the circumstance wherein the instructional press is extrinsic.

The performance predictions for each course taking into account the instructional press prevailing in that course are summarized in Figure 11-1C.

Figure 11-1
Predictions About Performance As A Function of Educational Set*

A. Main Effect of Set (Hypothesis III)

Educational Set	
Conceptual S	Factual S
$>M_t$	$<M_t$

B. Set x Manifest Objective (Hypothesis IV)

	Educational Set	
Manifest Objective	Conceptual S	Factual S
Manifest Conceptual O	$>M_c$	$<M_f$
Manifest Factual O	$<M_c$	$>M_f$

C. Instructional Press x Set x Manifest Objective

Instructional Press (and course)	Manifest Objective	Educational Set	
		Conceptual S	Factual S
Intrinsic (Zoology)	Conceptual	$>M_t$	$<M_t$
	Factual	$>M_t$	$<M_t$
Extrinsic (Physiology)	Conceptual	$>M_c$	$<M_f$
	Factual	$<M_c$	$>M_f$
Mixed (Educational Psychology)	Conceptual	$\gtrdot M_c$	$\lessdot M_f$
	Factual	$\lessdot M_c$	$\gtrdot M_f$

* M_t is mean of the total group; M_c and M_f are respectively means of the conceptually and factually set subgroups; $>$ denotes predicted performance considerably above, $\gtrdot$ denotes predicted performance slightly above, $<$ denotes predicted performance considerably below, and $\lessdot$ denotes predicted performance slightly below a mean.

Results and Discussion

Correlations Between Set and Criteria

The predictions in Figure 11-1C can be viewed from the standpoint of correlational analysis rather than variance analysis. When the instructional press is intrinsic (as in Zoology), this figure predicts a positive correlation between educational set and academic performance. However when the instructional press is extrinsic (as in Physiology) this figure predicts the absence of correlation between set and performance because of the hypothesized interaction between set and manifest objectives. Finally, given a mixed press (as in Educational Psychology) the correlation between set and performance should be intermediate between that obtained when the press is intrinsic and when the press is extrinsic.

The correlations between scores on our measure of educational set and the criteria were calculated for random samples of the full student enrollment in each course and are shown in Table 11-1. The coefficients are essentially as predicted in Figure 11-1C, although these predictions were more clearly verified for "acquisition" than for "thought relevance."

Table 11-1

Correlations Between Educational Set and Criterion Variables

		Criterion		
Course	Sample N	Factual Acquisition	Conceptual Acquisition	Thought Relevance
Educational Psychology	208	.18	.28	.12
Physiology	100	-.02*	.08*	.16*
Zoology	129	.24	.31	.10*

* Not significant with $p < .05$.

Analyses of Variance Results

Table 11-2 is an abbreviated extrapolation from Tables 7-1 and 7-2 showing the mean squares only for interactions involving educational set as a component. This table does not show the third-order interactions, although these were computed. Subgroup means for the statistically significant interactions noted in Table 11-2 are cited in Table 11-3.

Table 11-2

Analysis of Variance Summary: Educational Set As a Focal Variable

Source	Educational Psychology						Zoology (61-62)						Zoology (62-63)						Physiology					
	Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance		Factual Acq.		Conceptual Acq.		Relevance	
	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p	MS^x	p
Educational Set (S)	91		36		113		316	.05	439	.05	6		300	.05	341	.01	46		253		33		424	.01
Pr x S	15		5		237	xx	0		12		9		5		35		83		8		0		27	
O x S	72		0		3		30		86		1		36		1		65		9		42		5	
Con x S	4		153	.05	50		0		114		53		167	.10	14		3		94		31		51	
Ab x S	319	.01	50		15		5		27		1		98		12		3		105		39		3	
Mot x S	85		11		1		48		8		9		242	.05	35		62		2		2		39	
Pk x S	81		0		288	xx	14		37		2		124		1		2		53		31		24	
Pr x O x S	6		32		242	xx	140		31		3		6		1		20		14		77	xx	12	
Pr x Con x S	345	.01	1		3		124		62		32		43		25		54		5		103	xx	12	
Pr x Ab x S	69		0		102		7		126		17		0		0		4		8		6		3	
Pr x Mot x S	36		11		43		26		12		25		2		16		0		15		33		3	
Pr x Pk x S	3		2		14		7		17		0		11		0		122		0		33		19	
O x Con x S	1		3		58		2		54		38		2		9		16		336	.10	279	.01	10	
O x Ab x S	11		15		43		113		1		0		85		19		118		17		89	xx	74	
O x Mot x S	6		14		1		0		1		43		41		178	.05	2		4		39		49	
O x Pk x S	9		6		5		21		9		91		282	.05	68		160		113		75	xx	0	
Con x Ab x S	113		15		3		0		62		3		149		86		11		176		89	xx	16	
Con x Mot x S	20		17		200		55		3		0		26		31		2		2		7		25	
Con x Pk x S	0		21		6		10		33		48		1		9		19		32		71		77	
Ab x Mot x S	3		0		5		45		14		14		98		51		8		5		20		39	
Ab x Pk x S	3		10		15		6		3		0		124		4		3		129		56		4	
Mot x Pk x S	20		14		91		10		31		26		158	.10	118	.10	19		1		13		103	
Error MS	40.79		26.64		74.09		75.50		64.66		45.39		54.12		35.37		56.97		115.81		25.90		51.21	

x df = 1 always; MS and SS are identical

xx $p < .10$ but statistical significance is questionable

Table 11-3

Subgroup Means for Selected Significant Interactions With Educational Set as A Component Variable

Interaction	Course	Criterion	Interacting Variables		Educational Set	
					Conceptual S	Factual S
O x Con x S	Physiology	Factual	Con	Conceptual O	75.81	73.94
				Factual O	75.87	68.69
			No Con	Conceptual O	71.94	67.13
				Factual O	64.56	67.19
		Conceptual	Con	Conceptual O	49.62	49.43
				Factual O	51.12	47.31
			No Con	Conceptual O	50.31	45.50
				Factual O	46.18	49.56
O x Ab x S	Physiology	Conceptual	High Ab	Conceptual O	53.43	48.50
				Factual O	50.25	50.93
			Low Ab	Conceptual O	46.50	47.12
				Factual O	46.37	45.93
O x PK x S	Physiology	Conceptual	High PK	Conceptual O	51.81	49.12
				Factual O	48.31	50.93
			Low PK	Conceptual O	48.12	46.50
				Factual O	48.31	45.93
O x Pr x S	Physiology	Conceptual	Pr	Conceptual O	52.62	48.87
				Factual O	48.56	50.18
			No Pr	Conceptual O	47.31	46.75
				Factual O	48.06	46.68

Instructional Press x Set x Manifest Objective

Considered together, Hypotheses III and IV focus attention upon the interactions between educational set and manifest objective. As shown in Figure 11-1C, these hypotheses predict that the S x O interaction is most likely to be statistically significant in Physiology where the instructional press was extrinsic. These hypotheses also predict that educational set is not likely to interact with manifest objective in Zoology, where the press is intrinsic.

Although as shown in Table 11-2, the first order S x O interactions were not statistically significant in any of the courses, the second-order interactions including one additional variable did emerge as statistically significant (or very close to it) with much greater regularity in Physiology than in the other courses. By way of generalization about performance in this course, conceptually set students were adversely affected when factual acquisition was emphasized; conversely, factually set students were adversely affected when conceptual acquisition was emphasized. This finding is precisely what Hypothesis IV leads us to expect.

However it is important to note that this generalization about the S x O interaction in Physiology was conditioned in every case by a third variable. The power of the instructor's manifest objective in reinforcing educational set was particularly apparent when personal contact was an interactive component (Table 11-3: O x Con x S, Physiology). Without an opportunity for personal contact with the instructor, the learners were compelled to rely upon the three hourly course examinations for clues about the instructor's goals. Thus a performance decrement as a function of dissonance between set and manifest objectives was most evident under the "no contact" condition.

There is a tendency (borderline statistical significance) for the predicted O x S interaction in Physiology to hold for high but not for low ability students, and for high but not for low prior knowledge students, particularly when the criterion is conceptual acquisition. This is consistent with our presumption that cognitive deficit (either low ability or low prior knowledge) alone is sufficient to depress the level of conceptual acquisition.

Finally, there is a tendency for the predicted O x S interaction in Physiology to hold in proctored but not in unproctored settings. Given the disciplinary problem in unproctored sections of this course, this finding is not surprising.

It seems clear over-all, that the pattern of data supports Hypotheses III and IV and our generalizations about instructional press when a third conditional variable is added to the interaction between educational set and manifest objective.

Summary

A student's placement on the factual-conceptual set continuum is a "given" with which he enters a course. By the time he is an undergraduate, his educational set can be assessed reliably indicating that this is a stable rather than a transitory characteristic. Furthermore, as we have discussed in this chapter, educational set influences the quality of acquisition as follows:

1. When the instructional press is intrinsic, conceptually set students are more likely than factually set students to learn both conceptually and factually oriented content.

2. When the instructional press is extrinsic, academic performance is a function of the interaction between the student's set and the type of acquisition for which he is consistently reinforced. Performance is maximized when the student's set is congruent with the direction of learning emphasized by the instructor.

These findings suggest at least three problems for investigation with potential significance for structuring educational experiences to the idiosyncratic needs of the learner.

First, there is the issue of the role of instructional experiences in altering educational set. Both on the basis of our evidence and on intuitive grounds, a defense can be made for attempting to alter educational set in a conceptual direction. Further investigation is needed to determine the impact, if any, of specific kinds of instructional experiences upon the educational set with which the learner confronts those experiences. It is possible that by the time a student is an undergraduate, his educational set is relatively fixed and resistant to change. If this is the case, the present study suggests the wisdom of arranging for congruence between the student's set and the educational goals imposed upon him.

A second presently unresolved issue concerns the development of educational sets. Does the learner's general posture toward new material develop prior to or following early school experience? And what is its etiology? Since the correlation between set and academic ability is not especially high, we speculate that educational set somehow reflects a pattern of pre-school experiences and reinforcements.

Finally, it is appropriate to raise questions about the pervasiveness of educational set as a behavioral determinant. We have demonstrated the role of this variable as a partial determinant of subject matter acquisition. In the absence of additional data, it is tempting to hypothesize that the influence of this variable may extend beyond such acquisition to a fairly broad spectrum of behaviors and interests including curriculum election, vocational choice, job satisfaction, and so on.

CHAPTER 12

ADVANCED TELEVISED COURSES

Two courses primarily elective in nature and enrolling mostly juniors and seniors were taught experimentally by television: Business Psychology and Shakespeare. The pattern of investigation in these courses was identical with that followed in the three survey courses, with one exception: the presence or absence of a proctor was not systematically manipulated as an experimental variable in the advanced courses. Thus the design for each of these courses followed the requirements of a 2^6 analysis of variance with one case per cell.

The purpose of the studies in these two courses was to test the generalizability of findings from survey (freshman-sophomore) courses taught by television to advanced (junior-senior) courses also taught by television. Such a test is somewhat contaminated because the instructors and course contents also differed. However its significance rests upon the fact that students in the advanced courses were more mature, presumably more committed to scholastic endeavor, and were taking a course that they wanted to take rather than one to fulfill a university-wide graduation requirement.

Experimental Procedure

The basic research design was clarified in Chapters 3, 4, and 5. Because of the relatively small enrollments in these courses, the required data were accumulated across successive semesters. To maintain constancy of the televised presentations, these courses were presented "live" the first time, and by videotape during succeeding semesters. Business Psychology was offered twice and Shakespeare three times by tape.

Students taking Business Psychology by videotape were generally unaware that they were not viewing "live" instruction. In Shakespeare, the first videotaped presentation was presented as if it were "live"; the second and third of these presentations were obviously taped because the instructor was present in the receiving room while the tape was shown in order to effect "personal contact."

Statistical Design

The four learner variables (academic ability, motivation, educational set, prior knowledge) and two instructor variables (manifest objective, personal contact) were cast into a 2^6 analysis of variance design modeled after the 2^7 design used in the survey courses. Thus the matrix for each advanced course contained criterion scores for four sets of 16 critical subjects (N = 64).

The error terms for these analyses were pooled mean squares of the third, fourth, and fifth-order interactions (df = 22). We followed our earlier practice of using a .10 significance level because of the high mean squares of some of the components of each error term.

Learner Variables

The intercorrelations between the learner variables and the corrected split test reliabilities for these variables were calculated for the full enrollment in each course. These data are summarized in Table 12-1.

Table 12-1

Intercorrelations Between Learner Variables and
Reliabilities of the Instruments
(Advanced Televised Courses)

Course	Variable	Intercorrelations			Split-test Reliability
		Ability	Motivation	Set	
Business Psychology	Motivation	.08	X		.83
	Set	.27	.18	X	.84
	Prior Knowledge	.12	.13	.05	.74
Shakespeare	Motivation	-.14	X		.81
	Set	.42	-.05	X	.89
	Prior Knowledge	.09	.19	.03	.72

In Business Psychology the intercorrelations between the learner variables were sufficiently low to minimize the likelihood of spurious learner variable interactions attributable to differential regression. However we cannot similarly dismiss this as a possible factor contributing to significant interactions involving ability and set in Shakespeare.

In both courses the split-test reliabilities were satisfactorily for all variables.

Instructor and Environment Variables

Those conditions which were earlier designated "environmental" were not investigated in either course. All sections were proctored; all personal contact subgroups had opportunities for some discussion whereas all no-contact subgroups had no opportunities for discussion.

Two "instructor" variables, manifest objective and personal contact, were systematically manipulated. These manipulations have already been described in Chapter 5.

Results

Three analysis of variance summaries are shown for each course in Table 12-2. These three are for the criteria factual acquisition, conceptual acquisition, and relevance of thinking. (The analyses for "attentiveness" as a criterion are not shown because of the high correlation--in excess of .80--between attentiveness and relevance scores.)

Subgroup means for the significant F-ratios are summarized in Table 12-3 for Business Psychology and Table 12-4 for Shakespeare.

Discussion

In order to test the generalizability of principles generated from the televised survey courses, we used these same principles to predict results in the advanced TV courses.

Idiosyncratic Drive Patterns

The two constellations of idiosyncratic drive amenable to exploration by these designs were those related to (a) academic ability, (b) educational set.

Ability-Linked Drive.--Two hypotheses concerning the interaction of ability-linked drive and extrinsic circumstances were introduced in Chapter 10. These hypotheses stated that

I. Performance by low ability students is facilitated in environments reducing their perceptions of the likelihood of failure and/or directing their attention to the materials to be learned. The converse of these conditions inhibits the performance of low ability students.

II. Performance by high ability students is facilitated in environments providing an appropriate intellectual challenge. Unduly easy, unstimulating and unchallenging environments inhibit performance by high ability students.

Personal contact was one of the aspects of the environment which was deliberately manipulated as a potential inhibitor or facilitator of performance. You will recall the distinction in Chapter 10 between contact designed to clarify lecture content and contact designed further to explore the previously covered content.

In terms of Hypotheses I and II, contact providing additional clarification should facilitate performance by low ability students and inhibit performance by high ability students. Conversely, contact directed towards further exploration should facilitate performance by

Table 12-2

Analyses in "Business Psychology" and "Shakespeare"

Source	Business Psychology						Shakespeare					
	Factual		Conceptual		Relevance		Factual		Conceptual		Relevance	
	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F	MS^x	F
Manifest Objective (O)	36.00		22.56		97.51		689.06	9.65^c	21.39		162.56	
Personal Contact (Con)	10.56		20.25		0.76		0.56		656.64	12.80^c	138.06	
Academic Ability (Ab)	6.25		22.56		13.14		855.56	11.98^c	66.01		297.56	3.40^a
Motivation (Mot)	30.25		14.06		83.26		351.56	4.92^b	192.51	3.75^a	76.56	
Educational Set (S)	64.00	4.22^a	49.00	3.53^a	276.39	3.54^a	22.56		385.14	7.51^b	0.25	
Prior Knowledge (PK)	64.00	4.22^a	85.56	6.16^b	23.76		22.56		3.51		9.00	
O x Con	22.56		0.25		213.89		333.06	4.66^b	244.14	4.76^b	9.00	
O x Ab	0.00		22.56		28.89		390.06	5.46^b	8.26		225.00	
O x Mot	2.25		1.56		58.14		68.06		0.01		16.00	
O x S	0.00		36.25		15.01		175.56		107.64		0.06	
O x PK	4.00		7.56		2.64		27.56		54.39		0.06	
Con x Ab	68.06	4.49^b	16.00		107.64		138.06		34.51		702.25	8.03^c
Con x Mot	3.06		4.00		70.14		52.56		19.14		240.25	
Con x S	7.56		18.06		28.89		27.56		4.51		5.06	
Con x PK	52.56	3.47^a	72.25	5.20^b	15.01		68.06		2.64		27.56	
Ab x Mot	2.25		0.06		4.51		248.06	3.47^a	123.76		72.25	
Ab x S	4.00		2.25		83.26		10.56		1.26		85.56	
Ab x PK	30.25		10.56		8.26		451.56	6.32^b	15.01		39.06	
Mot x S	0.00		1.00		92.64		3.06		165.76	3.23^a	5.06	
Mot x PK	30.25		39.06		147.01		7.56		4.51		3.06	
S x PK	36.00		12.25		0.39		1.56		97.51		49.00	
O x Con x Ab	27.56		16.00		34.51		68.06		172.26	3.36^a	27.56	
O x Con x Mot	0.56		6.25		185.64		1.56		0.14		7.56	
O x Con x S	0.06		0.56		54.39		39.06		97.51		6.25	
O x Con x PK	14.06		4.00		50.76		14.06		23.76		225.00	
O x Ab x Mot	6.25		1.56		1.89		10.56		34.51		10.56	
O x Ab x S	1.00		16.00		13.14		588.86	8.24^c	83.26		144.00	
O x Ab x PK	2.25		0.56		28.89		18.06		74.39		6.25	
O x Mot x S	12.25		4.00		28.89		115.56		328.51	6.41^b	4.00	
O x Mot x PK	1.00		7.56		47.26		52.56		112.89		144.00	
O x S x PK	42.25		6.25		43.89		90.06		5.64		22.56	

Table 12-2 (Cont'd)

Analyses in "Business Psychology" and "Shakespeare"

Source		Business Psychology						Shakespeare					
		Factual		Conceptual		Relevance		Factual		Conceptual		Relevance	
		MS[x]	F	MS[x]	F	MS[x]	F	MS[x]	F	MS[x]	F	MS[x]	F
Con x Ab x Mot		0.56		1.00		11.39		68.06		0.14		105.06	
Con x Ab x S		0.06		3.06		3.51		85.56		1.89		182.25	
Con x Ab x PK		60.06	3.96[a]	20.25		4.51		1.56		0.14		441.00	5.05[b]
Con x Mot x S		1.56		1.56		34.51		1.56		15.01		42.25	
Con x Mot x PK		18.06		12.25		70.14		138.06		172.26	3.36[a]	210.25	
Con x S x PK		5.06		7.56		70.14		33.06		50.76		1.56	
Ab x Mot x S		0.00		4.00		13.14		588.06	8.23[c]	0.01		64.00	
Ab x Mot x PK		4.00		22.56		2.64		7.56		13.14		81.00	
Ab x S x PK		30.25		6.25		19.14		495.06	6.93[b]	8.26		68.06	
Mot x S x PK		2.25		9.00		54.39		7.56		8.26		14.06	
	d_f	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS	MS	SS
Total	63		1038		934		3858		8238		4537		5894
Error	22	15.21	335	13.93	306	77.92	1714	71.35	1569	51.18	1125	87.43	1923

x d_f = 1 always; MS and SS are identical

a/ $p < .10$; b/ $p < .05$; c/ $p < .01$

Table 12-3

Subgroup Means for Significant F-Ratios : Business Psychology

A. Main Effects

Source	Criterion	Condition	Mean
S	Factual	Conceptual S	43.93
		Factual S	41.93
	Conceptual	Conceptual S	35.21
		Factual S	33.46
	Relevance	Conceptual S	24.19
		Factual S	20.03
PK	Factual	High PK	43.93
		Low PK	41.93
	Conceptual	High PK	38.00
		Low PK	33.19

B. Interactions

Source	Criterion	Interacting Variables		Con	No Con
Con x Ab	Factual		High Ab	42.63	43.88
			Low Ab	44.06	41.19
Con x PK	Factual		High PK	43.44	44.44
			Low PK	43.25	40.63
	Conceptual		High PK	33.88	42.13
			Low PK	33.69	32.69
Con x Ab x PK	Factual	High PK	High Ab	43.00	44.13
			Low Ab	43.88	44.75
		Low PK	High Ab	42.25	43.63
			Low Ab	44.25	37.63

Table 12-4
Subgroup Means for Significant F-Ratios: Shakespeare

A. Main Effects

Source	Criterion	Condition	Mean
O	Factual	Conceptual O	40.56
		Factual O	47.12
Con	Conceptual	Con	71.96
		No Con	78.37
Ab	Factual	High Ab	47.15
		Low Ab	40.18
	Relevance	High Ab	28.91
		Low Ab	24.59
Mot	Factual	High Mot	46.18
		Low Mot	41.50
	Conceptual	High Mot	76.89
		Low Mot	73.43
S	Conceptual	Conceptual S	77.62
		Factual S	72.51

B. Selected Interactions Involving Manifest Objective (O)

Source	Criterion	Interacting Variables		Conceptual O	Factual O
O x Con	Factual		Con	38.38	49.50
			No Con	42.75	44.75
	Conceptual		Con	74.50	69.44
			No Con	77.00	79.75
O x Ab	Factual		High Ab	46.69	48.31
			Low Ab	34.44	45.94
O x Con x Ab	Conceptual	Con	High Ab	73.50	71.00
			Low Ab	75.50	67.88
		No Con	High Ab	80.75	79.50
			Low Ab	73.25	80.00

Table 12-4 (Cont'd)

C. Selected Interactions Involving Ab, Mot and S

Source	Criterion	Interacting Variables		High Mot	Low Mot
Ab x Mot	Factual		High Ab	51.81	43.19
			Low Ab	40.56	39.81
S x Mot	Conceptual		Conceptual S	78.50	76.75
			Factual S	73.88	71.56
Ab x Mot x S	Factual	High Ab	Conceptual S	55.63	41.38
			Factual S	48.00	45.00
		Low Ab	Conceptual S	37.50	43.25
			Factual S	43.63	36.38

D. Selected Interactions Involving Con and Ab

Source	Criterion	Interacting Variables		Con	No Con
Con x Ab	Relevance		High Ab	33.69	24.13
			Low Ab	22.75	26.44
Con x Ab x PK	Relevance	High PK	High Ab	32.88	27.25
			Low Ab	25.62	22.75
		Low PK	High Ab	34.50	21.00
			Low Ab	19.88	30.13

E. Selected Interactions Involving O and S

Source	Criterion	Interacting Variables		Conceptual S	Factual S
O x S x Ab	Factual	High Ab	Conceptual O	52.60	41.00
			Factual O	45.50	52.00
		Low Ab	Conceptual O	33.25	35.63
			Factual O	47.50	44.36
O x S x Mot	Conceptual	High Mot	Conceptual O	81.88	72.38
			Factual O	75.13	75.38
		Low Mot	Conceptual O	77.13	71.63
			Factual O	76.38	71.50
O x S x PK	Factual	High PK	Conceptual O	40.13	40.88
			Factual O	49.63	47.13
		Low PK	Conceptual O	45.50	35.75
			Factual O	42.50	49.25

high ability students and inhibit performance by low ability students. The contact provided in these two advanced courses was deliberately structured as "clarificatory" in Business Psychology and "exploratory" in Shakespeare.

The Business Psychology instructor conducted weekly seminars for the contact subgroup. During these seminars he was careful to restrict discussion of the previous week's lectures to a question-and-answer format. He used the seminar as a vehicle for further clarifying what had been presented in lectures without in any way probing the participant's comprehension or attempting further to explore the content. He answered students' questions about what had been covered. Any question that would have required the instructor to present additional information or concepts was deferred with some response like "Let's hold off on that until I have a chance to talk about it on TV."

In contrast, the physical arrangement for the contact condition in Shakespeare as well as the subject matter itself, made exploratory rather than clarificatory contact almost mandatory. The contact condition was created by having the instructor sit in with the class while his videotaped lectures were viewed. In the discussion following each showing, the instructor sought to evoke interpretations, understandings, relationships and insights going beyond what had been presented in the immediately preceding lecture.

Given these conditions, the appropriate predictions about Con x Ab interactions are summarized in Figure 12-1.

Figure 12-1

Performance Predictions As A Function of Con x Ab*

Course	Nature of Contact	Contact Condition	Effect Upon Performance By	
			High Ab Students	Low Ab Students
Business Psychology	Clarification	Con	Inhibit ($<M_H$)	Facilitate ($>M_L$)
		No Con	Facilitate ($>M_H$)	Inhibit ($<M_L$)
Shakespeare	Exploration	Con	Facilitate ($>M_H$)	Inhibit ($<M_H$)
		No Con	Inhibit ($<M_H$)	Facilitate ($>M_H$)

* Instructional press not considered.

Manifest objectives were manipulated in these two advanced TV courses by requiring selected students consistently to take either factually or conceptually oriented course examinations throughout the semester. There are at least two components of the manifest objective conditions: the content emphasized in the examinations (i.e., factual or conceptual); the relative difficulties of the examinations as a function of content emphasis. Previous discussions of *O x Ab* interactions in the survey courses rested upon the matter of difficulty. Since the conceptual form of each course examination was uniformly more difficult than the factual form of that examination, we predicted for the survey courses that the former would facilitate performance for high ability students and the latter would facilitate performance for low ability students. These predictions are summarized again in *Figure 12-2*.

Figure 12-2

Performance Predictions As A Function of O x Ab*

O Condition	Effect Upon Performance By	
	High Ab Students	Low Ab Students
Conceptual O	Facilitate ($>M_H$)	Inhibit ($<M_L$)
Factual O	Inhibit ($<M_H$)	Facilitate ($>M_L$)

* Instructional press *not* considered.

Comparing the predictions in Figures 12-1 and 12-2 with the appropriate findings in Tables 12-3 and 12-4, it is evident that when the *Con x Ab* and *O x Ab* interactions were significant at all, the performance patterns were as predicted.

Set-Linked Drive.--Two hypotheses (III and IV) about set-linked drive patterns were introduced in Chapter 11. Hypothesis III stated that, other things being equal, conceptually set students will outperform factually set students. (This hypothesis is the only one that will be discussed at this time. The discussion of Hypothesis IV, concerning the interaction *O x S*, must be deferred until after the subsequent discussion of instructional presses operating in these two courses.)

The prediction from Hypothesis III was verified for all criteria in Business Psychology and for conceptual acquisition in Shakespeare (Tables 12-2, 12-3, 12-4).

Instructional Presses

The concept we have designated "instructional press" results from the way in which the instructor conducts his course. Given an *extrinsic* press, students are much influenced by instructional conditions external to themselves. Given an *intrinsic* press, students are more responsive to their own needs, histories and abilities than they are to instructional circumstances.

Since the importance of instructional press as a partial determinate of instructional outcomes was not apparent to us at the inception of this series of investigations, we made no direct assessment of it. Instead, we were compelled to deduce the prevailing press from (a) the pattern of main effects generated in the course, (b) observations about the way in which the course was conducted and student reaction to it.

Judging from the main effects displayed in Table 12-2, the instructional presses in the advanced TV courses were neither as clearly intrinsic as in Zoology, or as clearly extrinsic as in Physiology. The main effects pattern for Business Psychology suggests a moderately intrinsic press; whereas acquisition here reflected differences in educational set and prior knowledge, acquisition did not reflect differences in ability or motivation. The pattern of main effects in Shakespeare suggests the existence in that course of a mixed press; acquisition reflected variations both in some of the learner variables and instructional conditions.

On the basis of anecdotal evidence alone, we would have concluded that the instructional press in Shakespeare tended more to be extrinsic than mixed, as an artifact of the constraints imposed by the experimental design. The students in this course were, for the most part, English majors in their senior year. They freely verbalized dissatisfaction and a sense of being "cheated" by televised rather than face-to-face instruction. Furthermore, students for whom factual acquisition was encouraged by course examinations in order to establish the manifest factual objective condition were particularly bitter about what they perceived as the insult of "irrelevant" and "inconsequential" test questions in a course they had so eagerly awaited as a capstone to their instruction in literature.

The significant main effect in Shakespeare for O (Table 12-4) is particularly interesting in the light of the foregoing impressions. The level of factual acquisition was enhanced for students assigned to the manifest factual objective condition. This shaping of educational performance by the content emphasized on the three hourly course examinations administered during the semester was unique to this course. The variable O did not lead to significant main effects for acquisition in any of the other courses.

The statistically significant O x Con interactions for both acquisition criteria in Shakespeare (Table 12-4B) are also interesting in the light of impressions about instructional press. We have already characterized contact in this course as "exploratory" rather than "clarificatory." In further exploring the content during periods of contact with the students, the instructor both displayed his own talents for synthesizing and integrating the subject matter and required students to do likewise. In other words, what we have designated as a conceptual focus was reinforced by the environment in the contact groups.

This conceptual focus generated by personal contact was either further reinforced by, or in conflict with, the course examination emphasis (manifest objective). For students in the manifest conceptual objective condition, both the O and the Con worked together to emphasize conceptual learning. However students assigned to the manifest factual objective condition experienced a conflict between what appeared to them to be important on the basis of their contact with the instructor, and what he tested for. Whereas contact reinforced conceptual acquisition, the course examinations reinforced these students for learning facts.

It is evident in Table 12-4B that congruence between the reinforcement provided by Con and O (both in the conceptual direction) enhanced performance on the conceptual criterion and impeded performance on the factual criterion. The same table shows the reverse effect when Con and O were dissonant.

Aside from our interest in these interactions for their own sake, their existence further corroborated the anecdotal impression that the instructional press in Shakespeare tended to be a mixture of intrinsic and extrinsic stimulants to performance. Had the course been offered in a face-to-face rather than a TV setting we think it likely that the instructional press would have been clearly intrinsic.

Pre-Course Attitude (Mot)

Students' pre-course attitudes were discussed as "sensitizers" in Chapter 8. We concluded in that discussion that favorable pre-course attitudes (high Mot) may maximize the power of other learner variables as determinants of performance. Conversely, low Mot may wash out the effects of these other learner variables.

This conclusion suggests the possibility of significant Mot x Ab and Mot x S interactions. It predicts that if these interactions are statistically significant, the interaction patterns will be as shown in Figure 12-3.

Figure 12-3
Predicted Interactions: Mot x Ab; Mot x S*

Interaction	Interacting Variable(s)		Effect Upon Performance By	
			High Mot Students	Low Mot Students
Mot x Ab		High Ab	>M	M
		Low Ab	M	<M
Mot x S		Conceptual S	>M	M
		Factual S	M	<M
Mot x Ab x S	High Ab	Conceptual S	>M	M
		Factual S	M	M
	Low Ab	Conceptual S	M	M
		Factual S	M	<M

* All entries make reference to M as the mean of the total group.

Although Mot did not influence performance in Business Psychology, it was a partial determinant of performance in Shakespeare. The interactions in the latter instance are summarized in Table 12-4C. The interaction patterns displayed there conform quite closely to the patterns predicted in Figure 12-3.

Interactions Reflecting Both Idiosyncratic Drive Patterns and Instructional Presses

Some refined performance predictions taking into account both the hypotheses about idiosyncratic drive patterns and instructional presses are summarized in Figure 12-4. This figure assumes an intrinsic instructional press in Business Psychology and a mixed press in Shakespeare.

In Figure 12-4, the first pair of refined predictions concerns the interaction Con x Ab, and the second pair of refined predictions concerns the interaction O x Ab. Both of these interactions were considered previously (Figures 12-1 and 12-2) without invoking the concept of instructional press in making predictions. The presumed effects of these presses are added to the predictions summarized in Figure 12-4.

Figure 12-4 also predicts the O x S interactions in the advanced courses. In the earlier discussion of set-linked drives we indicated that consideration of the O x S interactions would be deferred until the instructional presses operating in these courses had been clarified.

Ability-Linked Drive x Instructional Press.--The two interactions pertinent to hypotheses about ability-linked drive are Con x Ab and O x Ab. Preliminary predictions about these interactions were stated in Figures 12-1 and 12-2. These predicted patterns are regarded as "preliminary" because they were made without regard for instructional press.

The inclusion of instructional press in shaping predictions, as in Figure 12-4, permits a certain amount of refinement. As described earlier, particular kinds of instructional presses presumably enhance or "wash out" performance patterns attributable alone to idiosyncratic drive.

By considering the effects of both ability-linked drive and instructional press for the Con x Ab interaction, for example, Figure 12-4 predicts the possibility for statistical significance in Business Psychology but not in Shakespeare. Furthermore this figure states our expectation that if a significant Con x Ab interaction is in fact evident in Business Psychology, it will be characterized by superior performance in the no contact/high ability and the contact/low ability subgroups; performance in the two remaining subgroups is predicted to be undifferentiated.

Likewise by considering the joint effects of ability-linked drive and instructional press for the O x Ab interaction, Figure 12-4 predicts the possibility of statistical significance in both courses. However the predictions are not identical for the two courses. The figure anticipates a different pattern of subgroup means in each course and a greater

Figure 12-4

Some Refined Performance Predictions

Interaction	Course	Predicted Performance by Subgroup		
Con x Ab	Business Psychology		High Ab	Low Ab
		Con:	M_h	$> M_l$
		No Con:	$> M_h$	M_l
	Shakespeare		High Ab	Low Ab
		Con:	M_h	M_l
		No Con:	M_h	M_l
O x Ab	Business Psychology		High Ab	Low Ab
		Conceptual O:	$> M_h$	M_l
		Factual O:	M_h	$> M_l$
	Shakespeare		High Ab	Low Ab
		Conceptual O:	$\not> M_h$	$\not< M_l$
		Factual O:	$\not< M_h$	$\not> M_l$
O x S	Business Psychology		Conc. Set	Fact Set
		Conceptual O:	$> M_T$	$< M_T$
		Factual O:	$> M_T$	$< M_T$
	Shakespeare		Conc. Set	Fact. Set
		Conceptual O:	$\not> M_T$	$\not< M_T$
		Factual O:	$\not< M_T$	$\not> M_T$

likelihood of statistical significance occurring in Business Psychology than in Shakespeare. (Note the difference between these predictions and the preliminary predictions cited in Figure 12-2. Disregard for differences between the courses in instructional press led, in this earlier figure, to identical predictions for both courses.)

We consider first the interaction *Con x Ab*. The significant interaction obtained for the factual criterion in Business Psychology (Table 12-3B) followed the pattern predicted in Figure 12-4. This pattern was particularly evident in the low PK subgroup (*Con x Ab x PK* - Table 12-3B).

Whereas Figure 12-4 predicts no *Con x Ab* interaction in Shakespeare, and no such interaction was obtained with the acquisition criteria, this interaction emerged as statistically significant for the criterion, relevance of thinking (Table 12-4D). As noted earlier, the interaction pattern conformed to expectations on the basis of ability-linked drive alone, without the presumed "blunting" effect of the mixed instructional press.

With respect to the *O x Ab* interactions, Figure 12-4 predicts the possibility of statistically significant occurrences in both courses. This possibility was not confirmed in Business Psychology (Table 12-3). It was confirmed in Shakespeare for factual acquisition and for conceptual acquisition by the no contact subgroup (Table 12-4B).

To the extent that *Con x Ab* and *O x Ab* interaction patterns were predictable from the two hypotheses concerning ability-linked drive, they were predicted somewhat better by taking into account the prevailing instructional press than they were when the press concept was not invoked.

Set-Linked Drive x Instructional Press.--The main effects for S have already been discussed with reference to Hypothesis III. However we have deferred until now the discussion of *O x S* interactions, for which predictions rest upon Hypothesis IV.

Hypothesis IV, developed in Chapter 11, states that performance is facilitated by congruence between *O* and *S* whereas performance is inhibited by dissonance between *O* and *S provided the instructional press is not intrinsic*. (Given an intrinsic instructional press, Hypothesis IV is not applicable.)

This hypothesis is translated into performance predictions in Figure 12-4. Note that because of the intrinsic press attributed to Business Psychology, a significant main effect is predicted for S (Hypothesis III) and no *O x S* interaction is anticipated.

The predictions concerning S are confirmed in Business Psychology (Table 12-3). They are confirmed also in Shakespeare (Table 12-4E) for high, but not for low, ability students and for high, but not for low, motivation students. Although the significant *O x S x Ab* interaction here may reflect, in part, the moderately high correlation in Shakespeare between S and Ab, the pattern of significant interactions involving O and

S as components is reminiscent of the O x S interactions reported in Chapter 11 for Physiology. Whereas the first-order O x S interactions were not statistically significant in either Physiology or Shakespeare, the second-order interactions including one additional variable emerged as statistically significant with some regularity in both of these courses.

Furthermore the nature of the significant interactions in these two courses was similar: the predicted pattern of subgroup means held under favorable (e.g., high ability, or high motivation) but not under unfavorable (e.g., low ability, or low motivation) circumstances. Because of the similarities in instructional presses in Physiology and Shakespeare, we regard the similarities between O x S interaction patterns as real rather than illusory.

The interaction, O x S x PK, for factual acquisition in Shakespeare (Table 12-4E) also supports Hypothesis IV for all subgroups with the exception of the two high PK groups that were conceptually set. Mean performance in these groups may reflect sampling errors. Alternatively, these means may signify that when students in this course were forced to choose between performing in accord with their set and performing in accord with the instructor's manifest objective, they chose the latter. This phenomenon, if it existed, was not noted in any of the other courses.

In any event the evidence from the analyses in Business Psychology and Shakespeare lends further support to Hypotheses III and IV. Given an intrinsic press, conceptually set students tend to perform better than factually set students regardless of the criterion of performance or of the instructor's manifest objective (Hypothesis III). Given a mixed-to-extrinsic press, performance tends to be facilitated by congruence between the student's set and the instructor's manifest objective (Hypothesis IV).

PART IV

CONCLUSIONS

Chapter 13. Integration

Chapter 14. Some Implications

Since the analyses described in Part III revealed no essential differences in performance patterns associated with course level (survey courses vs. advanced courses), the five televised courses were not differentiated in assembling the conclusions and implications discussed in Part IV. Chapter 13 integrates the findings across courses. Some of the implications of these findings are discussed in Chapter 14.

Two general observations are appropriate preliminary to this concluding discussion.

First, all of the evidence was obtained in televised courses. Instructional television was used as a research tool enabling us simultaneously to manipulate desired classroom conditions while holding others constant.

Implicit in the paradigm for exploring the instructional gestalt is the assumption that superficial descriptions of the setting in which a course is offered--whether television, lecture, seminar, etc.--are less valuable for understanding and predicting educational performance than are carefully delineated features of the classroom environment, instructor behavior, and learner characteristics. Thus although the conclusions stem solely from investigations in televised courses, we tentatively regard them as being more generally applicable to various other settings offering the same kinds of constraints upon teacher and student behavior as does instructional television. Similar constraints are certainly evident in much of what is termed "lecture" instruction. Less apparent, perhaps, is the likelihood that similar constraints exist also in much so-called "conventional" instruction and even in certain seminar classes.

Second, in spite of the expedient of using instructional television as an experimental tool, certain important aspects of the instructional gestalt in each course were simply beyond empirical control. Aside from the replication in one course (Zoology), the conclusions are based upon five different courses involving different content areas and taught by different instructors.

These differences may account, in presently unknown ways, for the fact that some predicted performance patterns did not emerge as statistically significant in particular instances and therefore could not be tested. Such differences may account also for the fact that some predicted performance patterns were confirmed for certain criteria but were untestable for other criteria.

In view of the uncontrollable features of the instructional gestalts here explored, and the likelihood that we failed systematically to manipulate or control all of the pertinent features of the student -instructor-environment mix that could have been manipulated and controlled, it is encouraging that some meaningful patterns of educational behavior were identified. Furthermore, it is important to note that these behavior patterns as a function of instruction had not previously been identified in control group studies comparing student performance as a function of two or more grossly described instructional settings (e.g., televised vs. lecture vs. conventional instruction).

CHAPTER 13

INTEGRATION

The paradigm which guided the structure of the studies heretofore described developed out of our dissatisfaction with the emphasis of and yield from control group comparisons in educational research. We sought instead a paradigm that would enable us to investigate the unique mix of instructor behavior, environmental circumstance, and learner characteristics comprising a particular instructional setting. We were specifically interested in the interaction between learner characteristics (e.g., motivation, academic ability, educational set), instructor action (e.g., the kinds of examinations he administers, the type (if any) of personal contact he has with students), and features of the learning environment (e.g., amount and type of supervision). This mix is what we have termed the "instructional gestalt."

Instead of thinking in terms of a best way to teach something, the paradigm assumes (or at least makes it possible to demonstrate) that there are optimal ways to teach something to particular students. What "works" for one student need not work for another. The burden of investigations following this paradigm is to discover what works for whom and why.

Thus the learner assumes his proper place in the center of the educational research stage. But since there are many different kinds of learners, and many different kinds of instructional objectives, any course is really a series of plays running concurrently in spite of the fact that they are all simultaneously running in the same theatre. The paradigm was developed to help us discover why some of these are "hits" and others "flops." Its payoff will come when we can (a) identify those principles enabling us to maximize the attainment of particular objectives by each of the students and (b) translate those principles into appropriate instructional procedures.

The present chapter focuses upon the first of these outcomes by summarizing certain principles related to maximizing a student's educational performance.

The results obtained in the five televised survey courses seem generally to be explicable in terms of two organizing concepts. One of these concepts, that of instructional press, leads to predictions about the impact upon students of the particular way in which the instructional environment is managed. The other concept, that of idiosyncratic drive patterns, leads to predictions about the role of particular learner characteristics as partial determinants of the power and impact of specific instructional circumstances.

Instructional Press

The instructional press operating in a classroom results from the way in which the course is conducted. We distinguish between three general types of presses. In some classes student performance seems highly dependent upon the instructor's behavior and the environmental surroundings. We refer to the instructional press in these instances as extrinsic. In other classes, student performance appears more to reflect the characteristics of the learner than the instructor-environment conditions. Here we speak of the instructional press as being intrinsic. The many gradations of press between these extremes are described as mixed: i.e., performance reflects both learner characteristics and instructor-environment conditions.

Etiology of Instructional Presses

We believe at this point that the instructor is a key determinant of the press prevailing in his class. He communicates an attitude to his students by such behavior as his enthusiasm for the subject matter, the organization of his lectures, his rapport with the class, and so on. By his actions, the instructor implies to his students that he regards them as intellectually mature or immature: i.e., as capable of coping with appropriately difficult subject matter and assuming appropriate responsibility for their own learning, or as requiring an oversimplified presentation and continual supervision in order to learn.

An instructor who regards his students as intellectually mature generates an intrinsic instructional press. One who regards his students as intellectually immature generates an extrinsic instructional press.

Effects of Instructional Presses

Different presses are associated with corresponding differences in the effectiveness of instruction.

Assuming that an intrinsic press results when the instructor behaves as if the students are intellectually mature, then these students ought in turn to emphasize in their perceptions the potentially supportive aspects of the instructional environment. The instructor should be seen by them as helpful rather than punitive, his examinations as fair rather than unjust, and so on.

Conversely, if an extrinsic press results when the instructor behaves as if his students are intellectually immature, these students ought to emphasize in their perceptions the potentially punitive or threatening aspects of the instructional environment.

Thus we regard the instructional press of the classroom as a differential power factor affecting educational performance. Whereas all instructional environments are potentially punitive (or threatening) and potentially supportive to some students, the former aspect appears more powerful in the context of an extrinsic instructional press, and the latter as more powerful in the context of an intrinsic instructional press.

A more formal statement of this generalization follows:

An extrinsic instructional press sensitizes students to the potentially punitive and threatening (inhibiting) aspects of the instructional environment.

An intrinsic instructional press sensitizes students to the potentially supportive (facilitating) aspects of the instructional environment.

These effects are shown schematically in Figure 13-1.

But for whom is an aspect of the environment potentially inhibiting or potentially facilitating? This is the question to which the second organizing concept, that of idiosyncratic drive pattern, is addressed.

Idiosyncratic Drive Patterns

The distinction is often made between students who learn because they "want to learn" and those whose learning is motivated by such external rewards as graduation, approbation, and so on. Every student is sufficiently complex that both kinds of factors are at least partially responsible for his learning, but in individual instances one or the other is weighted more heavily. This idiosyncratic drive mix is brought by him into the classroom and may either be further reinforced by the instructional setting or conflict with the structure and demands of that setting.

The student's idiosyncratic drive patterns probably control his educational performance in two ways:

First, they determine the appropriateness or inappropriateness for him of selected aspects of the instructional setting. Obviously, provision of considerable opportunity for personal contact with the instructor, for example, is most appropriate for students needing a nurturant relationship and least appropriate for students not needing such a relationship.

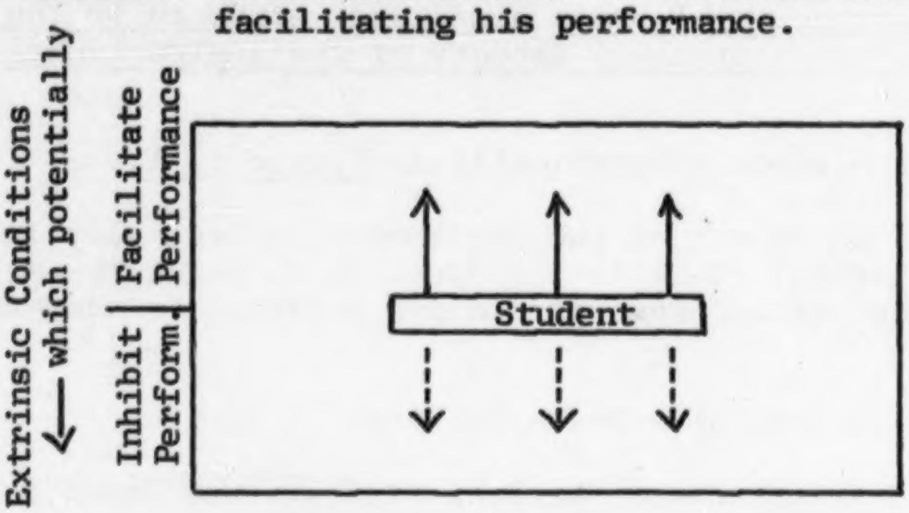
Second, his idiosyncratic drive patterns help shape the student's perceptions about, and his approach to, the course. We would expect a student who is taking a course primarily to fulfill a requirement, for example, to respond to it quite differently from one who enrolls because of a genuine pre-professional commitment to the discipline.

Kinds of Idiosyncratic Drive Patterns

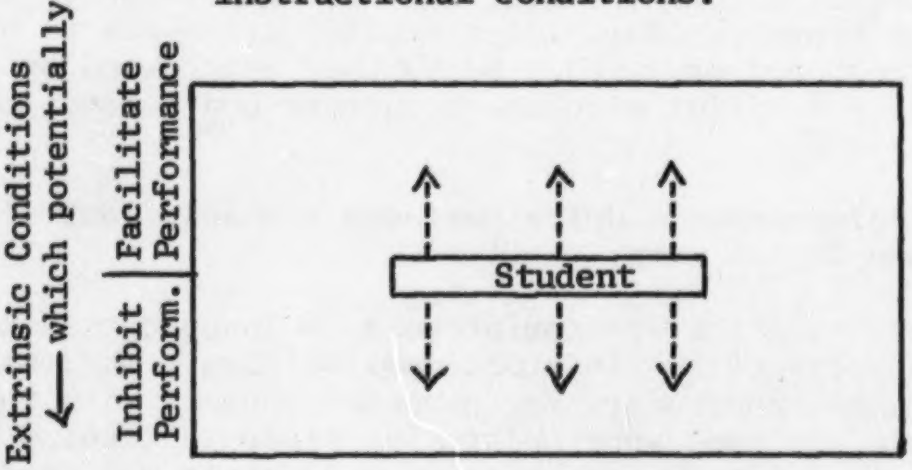
Although there are undoubtedly many kinds of idiosyncratic drive patterns, the research described in the preceding chapters has been especially concerned with just two. One of these is a function of the student's academic ability; the other is a function of his educational set. Our view of the origin of both patterns is that they are the current end products of the student's past history of successes and failures for cognitive attainments. Thus they are the givens with which he enters every course.

Figure 13-1
Schematic Representations of the Effects of Three Instructional Presses

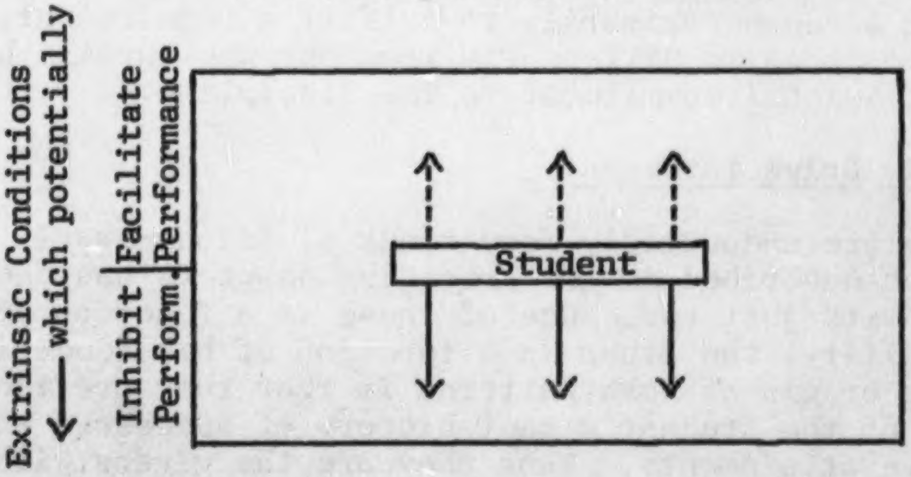
CASE I. Instructional Press is Intrinsic
Effect: Sensitizes learner to instructional conditions facilitating his performance.


Extrinsic Conditions
← which potentially
Facilitate Performance
Inhibit Perform.
Student

CASE II. Instructional Press is Mixed
Effect: Learner is relatively immune to influences from instructional conditions.


Extrinsic Conditions
← which potentially
Facilitate Performance
Inhibit Perform.
Student

CASE III. Instructional Press is Extrinsic
Effect: Sensitizes learner to instructional conditions inhibiting his performance.


Extrinsic Conditions
← which potentially
Facilitate Performance
Inhibit Perform.
Student

Effects of Idiosyncratic Drive Patterns

Other things being equal, high ability students will perform better academically than will low ability students, and conceptually set students will perform better academically than will factually set students.

These main effects may be accentuated or minimized by the student's level of intrinsic interest in taking the course. Thus the favorable effects of high ability and conceptual set are heightened when the student enters the course with a high motivational level. Conversely, these effects are minimized when the student is poorly motivated.

In addition to the organismic variable, motivation, the student's ability-linked and set-linked response patterns are affected by conditions of the instructional environment. Some environmental conditions facilitate performance whereas others inhibit performance. And the kinds of environmental conditions that are potential performance facilitators or inhibitors are different for high vs. low ability students, and for conceptually set vs. factually set students.

The Environment and Ability-Linked Drive.--Two hypotheses about the differential effects of selected features of the instructional environment upon performance by high and low ability students were introduced and discussed in Part III. The pertinent data suggest that:

1. Performance by low ability students may be facilitated when the instructional environment insulates them from intellectual threat and/or provides them with academic guidance. The converse of these conditions tends to inhibit performance by low ability students.

2. High ability students tend to perform best when the instructional environment offers appropriate intellectual challenges, whereas their performance may be inhibited when the environment presents inappropriately easy or unchallenging material.

The qualification may be facilitated (or inhibited) rather than will be facilitated (or inhibited) in the two statements above is not merely a cautious insertion. Whether or not potential performance facilitators or inhibitors become, in fact, facilitators or inhibitors depends upon the nature of the prevailing instructional press. This matter is discussed subsequently.

The Environment and Set-Linked Drive.--Two additional hypotheses introduced and discussed in Part III concerned the differential effects of selected features of the instructional environment upon conceptually set and factually set students. The pertinent data suggest that although conceptually set students tend, other things being equal, to perform better than factually set students, this idiosyncratic drive pattern also interacts with the prevailing instructional press.

Interactions Between Instructional Presses and Idiosyncratic Drive Patterns

The two sets of constructs, instructional press and idiosyncratic drive pattern, interact jointly to determine performance. Whether or not specific features of the instructional setting are potential performance facilitators or inhibitors depends upon the student's idiosyncratic drive pattern. Whether or not these potential performance facilitators or inhibitors become actual facilitators or inhibitors depends upon the prevailing instructional press.

The Interaction for Ability-Linked Drive.--Because of the interaction between instructional press and ability-linked drive, the potential facilitators of performance (insulation, and guidance for low ability students; intellectual challenge for high ability students) can be "washed out" by an instructional press that is extrinsic. These facilitators hold only when the press is intrinsic. Likewise the potential performance inhibitors (intellectual threat and lack of guidance for low ability students; inappropriately easy or unchallenging material for high ability students) actually inhibit performance when the instructional press is extrinsic. These potentially inhibitory effects are obscured when the press is intrinsic.

The implication, assuming that the instructional press is properly arranged, is that performance by low ability students can be maximized by placing them in educational settings that are protective: that is, settings wherein the instructor cannot probe in an intellectually embarrassing fashion and wherein the student does not feel unduly threatened by his failure to comprehend the instructional content.

The implication for high ability students has probably been more generally recognized. Assuming an intrinsic press, these students perform best in classes that stretch their intellectual resources by, for example, permitting intense and probing discussions.

The Interaction for Set-Linked Drive.--Although conceptually set students tend to perform better than factually set students, this generalization is applicable only in the context of an intrinsic instructional press.

Given an extrinsic press, which sensitizes students to potential performance inhibitors, academic performance deteriorates whenever the student's set and the instructor's content emphasis are dissonant. Thus if we are concerned solely with maximizing educational performance and the instructional press is mixed or extrinsic, it follows that we must allow students who are set to learn concepts to pursue this direction, and allow students who are set to learn facts to pursue that direction.

CHAPTER 14

SOME IMPLICATIONS

Unlike the preceding chapters, the present one is not data-bound. In it we have used the findings as a point of departure to state certain views about present practices and some possible changes in undergraduate instructional patterns. These views are consistent with the evidence we have previously presented; however they are not inevitable consequences of that evidence. The conclusions summarized in Chapter 13 have many more modest and limited implications than the ones we have elected to amplify here. Furthermore, those conclusions are not invalidated by the reader's possible rejection of any or all of the content of Chapter 14.

A Paradox

The results of the studies undertaken for this project are best considered against the background of other investigators' attempts to understand the instructional process. Taken together, all such studies suggest the existence of a very basic conflict between what we are attempting to do in our publicly supported colleges and universities on the one hand, and on the other, the evidence about how people learn. In spite of the multiple pressures for enrollment increases, research indicates that qualitatively superior instruction is possible only when that instruction is tailored to the histories, needs, interests, and abilities of each student.

Publicly supported higher education in contemporary American society has thus far failed to cope effectively with this conflict. For the most part it has not confronted the paradox generated by pressures toward enrollment increases and the antithetical conditions of effective learning. Continued failure to resolve this paradox must lead inevitably to a progressive deterioration of educational quality. The instructional denominators, both goals and methods, applied to students viewed en masse are not sufficiently appropriate for any substantial segment of the student body.

In exploring this paradox between enrollment pressures and the conditions of effective learning, we will draw upon evidence both from our own studies and those of other investigators. Then by interpreting this evidence against the background of the pressures upon publicly supported colleges and universities, we will build a case for some fairly drastic and specific changes in such institutions. To glance ahead, we will conclude that (a) classroom instruction during the freshman year ought to be abandoned and replaced by independent study; (b) the course

"Fundamentals of English Composition" which is extremely costly and relatively ineffective, ought to be removed as a requirement and replaced with a more effective and efficient system for developing writing competence; (c) instructors ought to function as members of a learning resources team rather than as independent agents; (d) each student ought to be guided into the particular classroom structure that will optimize learning outcomes for him.

These conclusions imply a pervasive view of the university's function: i.e., to help students learn to think and become intellectually flexible. Factual acquisition is not an appropriate goal in an era of rapid technological and social change. Thus we regard the implementation of these suggestions as contributing to the provision of qualitatively better instruction than is now the case. Furthermore, these improvements would not lead to an increase in over-all cost and might, in fact, lead to a cost reduction.

It is convenient to begin this consideration of the broad implications of instructional studies by stating some rudimentary generalizations about learners and learning and about teaching and teachers. (Although this preliminary discussion could have been given added breadth by considering interpersonal processes occurring between persons other than teachers and learners, and by considering the roles of such ancillary instructional participants as the student's family, teacher's colleagues, student's living group, and so on, these factors are not critical to our argument.)

Some Generalizations About Learning and Learners

Learning Involves the Entire Organism

The investigator's question when he studies the learning process is simple enough: "How do students come to modify their beliefs and their behavior?" Once phrased, this question must inevitably be elaborated by specifying what is to be learned. Although the language of elaboration differs among educational researchers and writers, they all make essentially similar distinctions between educational objectives and the processes appropriate for their attainment. In its most simple form, this distinction differentiates between factual vs. conceptual acquisition or, if you wish, between rote vs. meaningful learning, or, if you prefer, between associational vs. experiential learning. On the one hand, the student acquires knowledge by memorizing or imitating; on the other, he generates his knowledge by thinking.

There are two striking things about this type of distinction between instructional objectives.

First, and most apparent, virtually everyone who writes about higher education treats the "higher order" objectives such as thinking, conceptualizing, synthesizing, and openness to experience as primary. However whereas teachers, administrators, and students who are on the line, so to speak, often verbalize that these are their goals, they frequently settle for much less.

Second, and perhaps less apparent, is the artificiality of attempted distinctions between cognitive and noncognitive processes when these higher order objectives are emphasized. Such learning involves both the intellect and the viscera. The learner's attitudes, drives, and emotions interact with his sensory impressions and intellectual endowment jointly to determine the over-all impact of instruction. Thus learning is a unitary process involving the total organism.

Learning is Idiosyncratic

Classes do not learn; students learn. And the progress of learning for any student is marked by spurts, regressions, and apparent plateaus.

Thus when we speak of the "best" instructional arrangement for a class we are perpetuating a fiction, unless students are selectively assigned to that class rather than to some other with a different instructional arrangement. A view of instruction based upon our knowledge about learning is that to be efficient, instruction must so arrange the situational variables that they interact optimally with the learner variables. In this regard the studies of the instructional gestalt have suggested the existence of idiosyncratic drive patterns as a function of academic ability and educational set. There are undoubtedly other, perhaps equally important, idiosyncratic drive patterns that were outside the pale of this series of studies.

Learning is an Active Process

Contemporary society requires active student involvement and participation in learning. If we continue to treat students as passive -reactors (i.e., as persons to whom something is done) rather than as active participants, they will seek opportunities for participation and involvement outside of the classroom.

The activity, participation, and involvement to which we refer is not to be confused with the simple expedient of having students "take part" by doing something. Although a laboratory exercise, for example, requires activity from the student, it may or may not contribute effectively to his learning. The kind of activity we have in mind requires that learners perceive what they are doing as personally relevant. Thus participation and involvement cannot be inferred from the superficial appearance of the instructional setting. Some students listening to a lecture may be very active participants; others, despite their exposure to what have been termed "discovery experiences" may be passive.

Classical Learning Theories and Instruction

Several writers have noted that classical learning theories, whatever their strengths, are not especially pertinent to classroom instruction. In his postscript to the 1964 Yearbook of the National Society for the Study of Education ("Theories of Learning and Instruction") Hilgard, for example, notes that the era of the "great debate" among learning theorists is over. Instead of searching for generalized theories of learning applicable to instruction, attention is increasingly being given to developing theories of particular kinds of learning.

As they pertain to instruction, this means that such clusters of learning theory as "S-R," "cognitive," "identification," and so on, are regarded as compatible rather than competitive. Each one is valid for particular kinds of persons learning particular things in particular situations. Since there are several kinds of learning it is plausible to posit the existence of an equal number of conditions of effective learning (i.e., optimal instructional conditions).

Some Generalizations About Teaching and Teachers

Following the argument above, effective teaching is that which arranges instructional conditions in this optimal fashion. The mediator of effective teaching may be either a person (the teacher) or a teacher -substitute (as in the case of programmed instruction). As a matter of fact virtually all kinds of "instructional materials," including books, programs, and laboratory exercises to name a few, are capable of serving as effective teacher-substitutes if the circumstances are right. These materials may encourage learning and, at least under certain conditions, can provide the student with feedback about his performance.

An inherent limitation of instructional materials, however, is that they are relatively inflexible and therefore insensitive to individual differences between learners. What flexibility can be built in by, for example, arranging branches in programmed instructional materials, are relatively insignificant compared with the potential flexibility of human teachers.

Prescriptions for "how to teach effectively" are about as outdated as leeching. When offered and implemented they sapped the vigor of both students and teachers. In their place, teachers need to know the goals toward which they are striving, and the persons who they are teaching. With this knowledge, and assuming subject-matter competence, the teacher is enabled to do three things: (a) He can organize his teaching content so it most effectively encourages learning; (b) He can manage or structure the learning environment of his class to consist of micro-environments each appropriate for some of his students; (c) He can catalyze learning in which he cannot participate directly either because of personal or situational limitations.

However one teacher alone within the context of a university cannot function effectively in these ways without the support of the entire institution. Instructional objectives, whatever their nature, must pervade the curriculum before we insist that they become objectives of individual teachers. The learner's life space includes more than his experiences with any one teacher or set of teachers.

Given the pressures for enrollment with consequent increases in class size, and given the psychological naivete of most teachers (who after all are specialists in some other discipline), teachers cannot really know the persons who they are teaching unless they (the teachers) are assisted in this regard. Somehow information accumulated by undergraduate advisors, residence hall counselors, the university testing service, the admissions office, and the student's previous instructors must be made accessible to the teachers he now has.

Implications for Instructional Objectives

The search for greater "efficiency" in higher education is too often seduced by the model for increasing the efficiency of industrial organizations. For the latter, raising output while holding or reducing costs is a valid gain. In education, however, even if we can increase output without a corresponding increase in expenditures, we must question whether it is worthwhile doing more of whatever it is that we now do. Merely holding the line on quality while increasing quantity is probably not enough when our graduates must be prepared for societal and technological changes the specific nature of which cannot be anticipated with certainty by their teachers.

Thus institutions of higher education must make some decisions about their roles as agents for effecting personal change. We have already indicated that to be most effective, instruction must be tailored to the needs, capabilities, and histories of individual learners. Assuming that this is a feasible route toward optimizing education attainments, we must say something more about the attainments that deserve to be optimized.

In view of the range of attainments upon which higher education can focus, it is imperative that priorities be assigned so that the most important ones are emphasized by the entire curriculum. Without such priorities, the best we will be able to do is to identify those needs carried into a classroom by a student and arrange circumstances accordingly to facilitate efficient learning in that course. It takes a pervasive institutional philosophy (as distinguished from a handful of committed teachers) to prevent wasting student talent. No society--not even an affluent one--should permit a substantial number of potentially capable college students to bloom late, wilt early, or never to bloom at all.

In assigning priorities to the aims of higher education, top billing must be accorded such objectives as "adaptability" and "conceptualization." However in probing their implementation, it becomes evident that these constructs must be reduced to intensely personal and concrete goals suggesting appropriately personal and concrete curricula and instructional methods.

Implications for Curricula

At least three very specific areas of knowledge, understanding, and appreciation underlie the attainment of these goals: the past, the present, and oneself.

An understanding and appreciation of the past (communicated particularly through history and literature) serves at least two ends. First, it provides vicarious experiences which, in part, compensate for the severe limitations upon direct experience possible within a single lifetime. History and literature telescope experience for us. They enable us to grow without risking injury, and to think without having ourselves to work out of each dead-end encountered by our predecessors. Second, these disciplines along with philosophy provide perspective. An appreciation and understanding of the continuity between past and present, and of man's previous attempts to impose order upon the unknown, facilitates "conceptualization."

But knowledge of the past and of the continuity of past, present, and future, is not alone enough. People must understand themselves and others if they are most effectively to contribute to and function in society. The need for such understanding is by no means reduced in an era of rapid scientific and technological advancement. Because of their specialized knowledge, scientists must assume greater rather than lesser social responsibility than ever before for the impact of their discoveries and innovations.

The universities and colleges can contribute to the realization of these goals in at least three ways.

First, the curriculum must be freed from the artificial compartmentalization of knowledge as represented by discrete courses and textbooks. We all recognize that each discipline is simply a way of looking at the world, emphasizing some of its attributes and deemphasizing others. To counteract the inevitable distortions produced by these distinctions of convenience, students must be made to feel the interrelatedness of knowledge.

Second, the behavioral sciences should be made more central to curriculum planning and implementation. By this I mean not only that principles from the behavioral sciences ought to determine the arrangement of the curriculum and instructional experiences, but also that psychology, sociology, and anthropology be accorded more central status as components of that curriculum.

The world is populated by people; in learning about it, and in developing a personal relationship to it, students need to know as much as we can tell them about human behavior. The development of sensitivity, empathy, and self-knowledge is too critical to be left to chance.

Third, teachers themselves must have a better understanding of human behavior than is now usually the case. It seems to us remarkable that we so often entrust such great responsibility for shaping the values and destinies of each coming generation to persons who lack such understanding both as regards themselves and the students they instruct.

Three Proposals

Undergraduate curricula and instructional practices have, in some degree, been enslaved by the traditions of which they were born. There are limits to the extent to which we can expect successfully to superimpose elements of an educational "new look" upon the existing structure.

As with a building, a foundation will accommodate only so many modifications before it creaks, cracks, and finally collapses.

Weighing together what we see as the interaction between idiosyncratic drive patterns and instructional presses on the one hand, and enrollment pressures on the other, it seems to us evident that significant qualitative instructional improvements can be effected by incorporating three changes in the usual pattern of undergraduate instruction. These changes would entail revamping the way in which (a) the freshman year is handled, (b) writing competence is taught, (c) teachers at all undergraduate levels function, and students are assigned to class sections. Each of these changes is discussed separately below.

The Freshman Year

In our attempts to process students we are forced particularly to increase class sizes in freshman courses, and to make graduate students increasingly responsible for freshman instruction. This is a time of trauma for many students. The competition for survival is keen; the community of scholars sometimes resembles a community of gladiators.

In addition to its cost calculated in psychic terms, the freshman year must be regarded as a serious drain upon the financial resources of publicly assisted four-year institutions. Direct instructional costs for courses taken exclusively or primarily by freshmen account for one-third or more of an institution's total undergraduate instructional budget. It is probable that only 40-45 per cent of these freshmen will ever be graduated by the institution. Thus we can estimate conservatively that instruction to freshmen who will eventually be graduated costs twice as much per student as does instruction to upperclassmen.

Even more important than the dollar cost is the cost calculated in terms of the faculty's instructional time. In order to allow for transfers and scholarship drops during the freshman year, a publicly assisted institution must commit close to one-half of its available undergraduate instructional personnel and resources to providing classes for freshmen.

If we admit frankly that the freshman year is a time for surveying large blocks of knowledge and accumulating some basic intellectual tools, the locus of instruction during this year ought to be the automated library rather than the classroom. Admission to upper-division study can be determined by performance on standardized achievement tests administered whenever the student feels he had prepared himself sufficiently well.

With an emphasis upon independent rather than classroom learning, the activities of the freshman year could be more effectively tailored to each student's idiosyncracies than is now the case. Aside from a possible orientation sequence for all freshmen, these students would be free to draw upon such resources of the university as the library, laboratories, instructional programs, and so on, to proceed through the core program at their own pace. Tutors could be made available for individual consultation by the student whenever he felt the need for such advice and guidance. If the social consequences of freahman year attendance on the campus are important to the institution, "freshman" students could live in residence halls as at present.

Aside from the qualitative improvement resulting from this plan, it is economically feasible.

Consider a hypothetical institution with a freshman class numbering 2000 students. Under the present program each student takes 5 courses. Thus the institution provides for 10,000 freshman student-courses (or 30,000 freshman student-contact-hours per week). Conservatively, 150 faculty members are required to handle this load. If the average annual salary is $10,000, the direct instructional cost for freshman courses is $1,500,000.

In contrast the same number of students studying independently as outlined above would have a maximum of 5 individual tutorials per week (one for each "course"). The 10,000 weekly student-tutorial contacts would require about 250 tutors assuming each could conduct 20 tutorial sessions per week and that substantial numbers of students will have been sufficiently prepared to take the standardized examination at the end of one semester or quarter rather than at the end of the full year. Since tutors would hold the master's degree rather than the doctorate, an annual salary of $5,000 would be appropriate in the present market. The direct instructional cost for the freshman year conducted in this manner would thus be about $1,250,000. Any saving in direct instructional costs over the traditional program could be committed to improving the institution's resources and facilities for independent study.

The faculty members freed from offering courses to freshmen by this arrangement could be redeployed to upperclass level courses. Staff recruitment problems are obviously eased in an institution that has its own faculty pool upon which it can draw to handle its expanding upperclass needs. As a result of this program we can even anticipate some reduction in the sizes of upper-division classes assigned to any one instructor.

Instruction in Composition

The course Fundamentals of Composition is, in some form or other, a bulwark of the undergraduate curriculum. The effectiveness of such a course for teaching students to write is open to some question. More importantly, there have been numerous demonstrations that much of what students learn in this course is not effectively transferred by them to their writing efforts in other courses.

It seems that a significant qualitative improvement could be easily effected by removing this course from the curriculum entirely. It might well be replaced by a program requiring at least one written assignment in every other course the student takes. Each of these assignments would be graded for style, composition, etc., by an English tutor who would meet individually with the writer to discuss the paper. This curricular change could be accomplished as (or even more) cheaply than the present arrangement for teaching Composition and has the virtue of encouraging a pervasive emphasis upon writing throughout the entire undergraduate curriculum. Furthermore, it would facilitate attentiveness to the idiosyncracies of acquiring this important constellation of skills.

Teaching Practices and Sectioning Students

The effective management of classroom learning, in the sense that we conceive of it, requires teachers with advanced knowledges, skills, and attitudes with respect to human development and behavior as well as subject matter. The distressing fact is that college teachers have had little, if any, training in how learning can be managed. Whereas many of us are highly professional in our attitudes towards our scholarly disciplines, our responsibilities as catalysts for learning may be discharged superficially by assigning readings, meeting lectures, and administering some sort of examination for grading purposes.

This section first presents a contrasting view of the way in which teachers ought to function; this is followed by a suggestion about how they can be helped to function in this way.

How Should the Undergraduate Teachers Function?--We envision the teacher as continuing to function as a manager of and catalyst for learning. However instead of performing these functions as an independent agent, we envision his participation as a member of a "learning resources team." As a result of this team effort,

1. each student's previous attainments, cognitive development, and affective development will be continually monitored.

2. appropriate goals will be set for that student on the basis of the results of (1) above.

3. a selection will be made from the full armamentarium of instructional aids (including books, seminars, TV tapes, programs, etc.) of those that are best calculated to help the learner progress towards the goals set in (2) above.

How Can Teachers Be Helped to Function This Way?--Two supporting all-university offices will be required to supplement each teacher's efforts. Along with the teacher, these offices will comprise the "learning resources team."

One of these offices will be responsible for monitoring those student characteristics contributing to idiosyncratic drive patterns. It will collate all information available about each student's previous academic performance and periodically assess psychological characteristics known to be related to the differential effectiveness of alternative instructional settings.

The other all-university office will work closely with teachers, helping them to design instructional settings. In designing these settings a rapprochement between the aims of the curriculum and the objectives of an isolated learning experience (or course) will have to be effected. In addition, no instructor can be expected effectively to implement an instructional setting that conflicts in serious ways with his own personal needs and gratifications.

Taken together, these two all-university offices will make it possible to optimize instruction for each student. One will guide the student into the instructional setting calculated to be most effective for him; the other will guide the instructor in establishing and maintaining a particular kind of instructional setting.

This arrangement can be implemented most easily at the level where it is most necessary: i.e., in the first two undergraduate years of a four-year program. This is where the registrations are the largest, where multiple-section courses are the rule rather than the exception, and where academic mortality is the highest.

In brief, the plan would replace the presently unsystematic, irrational, and usually impersonal assignment of students to sections with one that is highly systematic, rational, and personal. Instead of allowing students to register for sections on the basis of a combination of what they hear on the campus grapevine and intuition, or alternatively, instead of permitting a computer to section on the basis of available student-stations at given hours, each student will be guided into particular sections because of his particular constellation of organismic characteristics.

Considering the other side of the coin, instead of playing it so much by ear, each teacher will be guided in conducting his section by a clear notion of the kind of instructional environment he is to provide and how he is to provide it.

The plan can be implemented also in courses offered in only one section, but this will require even more sophisticated teachers. This is so because the teacher here will have to structure multiple learning experiences each optimal for a subset of his students. However, the "learning resources team" concept is still applicable.

PART V

SPECIAL PROBLEMS

Chapter 15. Creativity

Chapter 16. Course Examinations

Chapter 17. Relevance of Thinking

Part V is an addendum to the report of the basic series of investigations. In it we explore three "special problems": the role of "creativity" as a learner variable; the impact of subject matter emphasis displayed by the instructor to his class through his course examinations; the determinants of relevance of thinking in class.

The first of these problems is discussed in Chapter 15. Whereas the basic design implemented in all courses involved the selective assignment of students to instructional conditions on the basis of four organismic variables (academic ability, motivation, educational set, prior knowledge), a measure of "creativity" was added to the design as a fifth organismic variable in selected sections of Educational Psychology.

Although course examinations as an instructor variable (i.e., manifest objective) and relevance of thinking as a criterion have already been discussed at some length, these variables are considered from a different perspective than formerly in Chapters 16 and 17.

The discussion of course examinations heretofore has emphasized discrepancies in the relative difficulties of factually oriented and conceptually oriented examinations administered throughout the semester. Only passing references were made to the possible impact of the examination orientation itself. Apart from the role of difficulty, numerous authors have suggested that course examinations shape acquisition by virtue of their content. According to this argument students are most likely to learn whatever content the instructor emphasizes by his examination questions during the semester. Chapter 16 considers the data on the impact of manifest objectives in the light of this argument.

Chapter 17 similarly reconsiders data already presented for the criterion "relevance of thinking." In particular, we have thus far merely observed that the correlations between thought relevance and end-of-course acquisition are relatively low. We have not made a major point when discussing student performance, of differentiating between performance defined by acquisition and that defined by thought relevance. Chapter 17 is devoted specifically to a discussion of some determinants of relevance of thinking.

CHAPTER 15

CREATIVITY

In the context of the broader research program, the study of "creativity" as one of the constellation of learner variables was relatively minor. Since this variable was made part of the design in one course only, we did not attempt to identify idiosyncratic patterns of learner drive associated with different levels of creativity. Instead we held the more limited goal of determining the effect of televised instruction upon educational performance by students who differed in "creativity."

This issue is interesting in two ways.

First, some writers (e.g., Getzels and Jackson, 1962) have speculated that increments in academic ability or IQ beyond some level are relatively inconsequential. They argue that beyond this ability level, creativity rather than a further ability increment is associated with improved educational performance. This argument implies an interaction between academic ability and "creativity." Presumably the difference in performance between high and low ability students should be greater for high than for low creatives. By inserting "creativity" as a learner variable in our basic design we were able to test the existence of this interaction.

Second, assuming creativity can be properly defined and measured, there would seem to be a fundamental inconsistency between the educational needs of "creative" learners and the opportunities provided them in televised classes. If we accept Guilford's view of creativity as a predisposition for divergent (rather than convergent) thinking, then we would anticipate that televised instruction would be more appropriate for uncreative students than for creative students. Presumably the latter would thrive best in educational settings encouraging their predisposition and talent for thinking around problems rather than in settings tending to dispense answers.

Thus the analyses for "creativity" were approached with two questions:

1. Do academic ability and creativity interact as joint determinants of educational performance?

2. Is there any evidence that televised instruction is more appropriate for relatively "uncreative" than relatively "creative" students?

Definition of Creativity

The quotation marks for designating creativity do not appear hereafter because this variable is operationally defined by the instruments used for its assessment. As discussed in Chapter 4, we defined this variable by performance on two tests: Consequences and Pertinent Questions.

A student's classification with respect to creativity was a composite of the three scores yielded by these two tests. Those students scoring at or above the 70th percentile on at least two of these measures and who were not below the 30th percentile on the third were classified as "high creatives." Those who earned scores at or below the 30th percentile on at least two of the measures and who did not score above the 70th percentile on the third were classified as "low creatives."

Research Design

The design for this study has already been described in Chapter 3 (Figure 3-4, Design C). This investigation utilized five learner variables and two instructor variables. The latter involved the usual manipulations of manifest objectives and personal contact. Thus the design was implemented by identifying four sets of 32 critical subjects each, and assigning these sets randomly to the four TV receiving sections presenting the desired manifest objective-personal contact combinations. All sections were unproctored and no provision was made for discussion following the TV lecture.

The statistical procedure was analysis of variance computed in accord with the considerations clarified earlier in this report.

The course selected for this study was Educational Psychology. This was a somewhat unfortunate choice, although we could not have known it at the time data were collected. Since the instructional press in this course was "mixed," it is likely that it generated fewer significant interactions than would have been the case in a course that had either an intrinsic or extrinsic instructional press.

Results

The analysis of variance summary is presented in Table 15-1. Whereas main effects are summarized for all variables, interactions are cited only for combinations including creativity as one of the components. For simplicity, data are presented only for the first and second order interactions, although mean squares were computed also for the third order interactions. The error term was the pooled mean square for the remaining interactions (fourth, fifth, and sixth orders -- df = 29).

Subgroup means for the statistically significant interactions noted in Table 15-1 are cited in Table 15-2.

Table 15-1

Analysis of Variance: Main Effects and Interactions Involving Creativity

Source of Variation		Criterion					
		Factual Acquisition		Conceptual Acquisition		Relevance of Thinking	
		M Sq*	F	M Sq*	F	M Sq*	F
O : Manifest Objectives		0.03		3.12		0.38	
Con: Personal Contact		60.50		30.03		70.50	
Mot: Motivation		75.03		0.12		20.32	
S : Set toward Education		108.78		0.28		31.00	
PK : Prior Knowledge		406.12	9.21^c	108.78		1.75	
Ab : Academic Ability		1526.28	34.61^c	2032.03	52.33^c	267.38	4.84^b
Cr : Creative Ability		112.50		66.12		20.32	
O x Cr		52.53		12.50		4.88	
Con x Cr		72.00		0.78		79.69	
Mot x Cr		3.78		8.00		13.13	
S x Cr		38.28		38.28		43.94	
PK x Cr		4.50		0.28		43.94	
Ab x Cr		52.53		101.53		23.63	
O x Con x Cr		399.03	9.05^c	22.78		110.63	
O x Ab x Cr		190.12	4.31^b	81.28		79.69	
O x Mot x Cr		21.12		18.00		0.00	
O x S x Cr		36.12		11.28		261.63	4.74^b
O x PK x Cr		3.78		7.03		43.94	
Con x Ab x Cr		2.53		0.50		142.38	
Con x Mot x Cr		11.28		11.28		64.69	
Con x S x Cr		7.03		45.12		92.82	
Con x PK x Cr		1.12		2.00		388.50	7.04^b
Ab x Mot x Cr		24.50		13.78		73.50	
Ab x S x Cr		4.50		3.12		228.44	4.14^a
Ab x PK x Cr		13.78		6.12		20.32	
Mot x S x Cr		15.12		26.28		202.50	3.67^a
Mot x PK x Cr		0.03		2.53		14.44	
S x PK x Cr		5.28		45.12		0.00	
	df	M Sq	Sum Sq	M Sq	Sum Sq	M Sq	Sum Sq
Error	29	44.10	1278.94	38.85	1126.69	55.17	1600.05
Total	127		7853.50		5599.88		9580.06

*Since df is always 1, the sum of squares is the same as the M Square.

$^{a}p < .10$ $^{b}p < .05$ $^{c}p < .01$

Table 15-2

Subgroup Means for Significant Interactions Noted in Table 14-1

Interaction	Criterion	Interacting Variables		Creativity High Cr	 Low Cr
O x Con x Cr	Factual	Conc. O	Con	52.4	52.8
			No Con	52.6	50.0
		Fact. O	Con	56.8	48.6
			No Con	50.5	52.6
O x Ab x Cr	Factual	Conc. O	High Ab	57.6	53.3
			Low Ab	47.4	50.6
		Fact. O	High Ab	56.9	54.9
			Low Ab	50.4	46.3
O x S x Cr	Relevance	Conc. O	Conc. S	23.9	20.2
			Fact. S	18.8	24.0
		Fact. O	Conc. S	20.8	23.9
			Fact. S	21.0	21.0
Ab x S x Cr	Relevance	High Ab	Conc. S	24.8	22.2
			Fact. S	20.0	25.8
		Low Ab	Conc. S	20.1	21.5
			Fact. S	20.0	19.2
Mot x S x Cr	Relevance	High Mot	Conc. S	22.5	20.8
			Fact. S	19.9	25.7
		Low Mot	Conc. S	21.7	23.0
			Fact. S	20.7	19.4

Discussion

It is evident from Table 15-1 that creativity as defined by our measure did not greatly influence criterion performance in Educational Psychology as conducted by television. Whereas powerful main effects were obtained with academic ability for all criteria, no significant main effects were obtained for creativity.

Cr x Ab

As one of the two problems for investigation, we raised the question of whether significant Cr x Ab interactions would occur. If these data were to substantiate the conclusions of Getzels and Jackson (1962) such an interaction ought to have appeared with the pattern of subgroup means shown in Figure 15-1.

Figure 15-1
Cr x Ab Interaction Pattern Inferred from Conclusions by Getzels and Jackson (1962)*

	High Cr	Low Cr
High Ab	$<M_h$	$>M_h$
Low Ab	M_l	M_l

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* The entries M and M_l refer respectively to the means of the high and low ability subgroups.

Although the first order Cr x Ab interactions were not statistically significant for any of the criteria, two statistically significant second order interactions involving Ab and Cr as components were obtained. These were the interactions O x Ab x Cr, Factual Acquisition; S x Ab x Cr, Relevance. The patterns of subgroup means for these interactions do not correspond to the pattern inferred in Figure 15-1.

Thus taking these data at face value, it does not follow that increments in creativity are more beneficial for high than for low ability students or, conversely, that ability increments are any less beneficial to low than high creatives. Although this may be the case under certain circumstances (e.g., when course examinations emphasize conceptual content, or when students are conceptually set), it is clearly not the case under other circumstances (i.e., when course examinations emphasize factual content, or students are factually set).

Appropriateness of TV Instruction as a Function of Creativity

We concluded in Chapter 10 (concerned with ability-linked drive) that the optimal learning environment for low ability students was "protective" and "non-threatening" whereas the optimal learning environment for high ability students was one offering an intellectual challenge. Other things being equal, the anonymity and intellectual protectiveness of televised classes tend more to meet the requirements of low ability students. In order for televised instruction to be appropriate for high ability students special provisions for such challenge had to be incorporated in the setting.

This issue is now explored for students differing in creativity rather than academic ability.

Of the criteria employed in this investigation, only "relevance of thinking" seemed especially pertinent to clarifying the role and importance of creativity. You will recall that this criterion was temporarily and qualitatively different from the acquisition measures. Whereas the latter are delayed measures reflecting the impact of various uncontrollable factors and constraints, relevance of thinking is immediately available and relatively uncontaminated. Because of the relative permissiveness and privacy of criterion behavior designated "relevance" we anticipated that it would be most likely to be sensitive to the kinds of differences implied by variations in creativity.

Three of the four statistically significant interactions for this criterion involve educational set as a co-determinant with creativity of performance: O x S x Cr, Ab x S x Cr, Mot x S x Cr. Furthermore the subgroup mean patterns shown for these interactions in Table 15-2 are notably similar to each other and to those discussed in Chapter 11 (set-linked drive).

Chapter 11 emphasized the importance of congruence between the student's set and the instructor's manifest objective. The data in Table 15-2 seem similarly to indicate the importance of congruence between the student's set and his creativity level. Relevance of thinking is maximized for high creatives who are conceptually set and low creatives who are factually set--at least when ability and motivation are high. (We have several times earlier mentioned the tendency for cognitive and motivational deficits to depress performance levels thereby obscuring any underlying interactions.)

That set should interact with creativity is not surprising. If high creativity indicates an ability to think divergently, this ability ought to be used more effectively by conceptually than by factually set students. Likewise if low creativity indicates an ability to think convergently, then this ability ought to be used more effectively by factually than by conceptually set students.

We cannot conclude from these findings that televised instruction is any more or less appropriate for high than for low creatives. There is evidence that if other circumstances are "right" both high and low creatives will think relevantly during class in spite of the fact that the presentations are mediated by television. Thus, as we have seen before in other contexts, the impact of the mechanics of classroom instruction upon performance cannot be generalized. More important than the mechanical arrangements alone are the stimulation and freedom from inhibition afforded by these mechanical arrangements to individual students.

Conclusions

The data from this minor investigation do not show the existence of an interaction between academic ability and creativity. These data likewise do not demonstrate that a convergent instructional setting, like television, is any more facilitative for low than for high creatives.

In spite of these negative findings, the data are of some interest because of the nature of the interactions involving both set and creativity. If creativity is conceived as an ability, then we have some evidence for role of set as a determinant of the effective use of that ability. Divergent abilities are most effectively used by conceptually set students; convergent abilities are most effectively used by factually set students.

References

Getzels, J. W. and Jackson, P. W. Creativity and Intelligence. N.Y.: John Wiley and Sons, Inc., 1962.

CHAPTER 16

COURSE EXAMINATIONS

In summarizing a prevailing view of the role of course examination content in shaping acquisition, McKeachie (1962) states:

> "Because grades are important to them, students will learn whatever is necessary to get the grade they desire. If we base our grades on memorization of details, students will memorize the text. If they believe our grades are based upon the ability to integrate and apply principles, they will attempt to do this."

This widely held generalization suggests the possibility of shaping student acquisition by manipulating the content of course examinations. It implicitly assumes that students as a group are more likely to respond to extrinsic pressures (e.g., to earn grades) than to their intrinsically based needs.

While this is undoubtedly true for certain students under certain conditions, we have already presented some evidence questioning both the impact of course examinations as shapers of acquisition and the underlying assumption. If the course examination content effectively shaped student behavior, this should have been reflected in main effects for the variable we designated manifest objectives. In particular, conceptual acquisition should have been greater for students under the manifest conceptual treatment; and factual acquisition should have been greater under the manifest factual than under the manifest conceptual treatment.

That these results were not obtained can be interpreted in two ways.

This failure can be construed as indicating a weakness in the design: i.e., either the three hourly examinations in each course were not satisfactory for establishing the desired orientations toward factual and conceptual acquisition, or the criteria of conceptual and factual acquisition were not satisfactory in any of a number of ways.

Although these are possible criticisms of the design, we do not give them much credence. Following each examination many students verbalized freely about the kind of content over which they were tested. They seemed to recognize that they had either taken an hour examination that "really made you think" or that "just asked you to recall." They seemed similarly to be aware of the difference between the items comprising the two parts of the final examination (conceptual and factual) which provided our criterion scores.

In view of the orientation of the main body of this report, it is obvious that we favor quite a different view of the role of examination content from that summarized by McKeachie. And we tend to accept the failure to demonstrate the significant main effects anticipated by this generalization as support for our own view.

Briefly stated, we regard course examinations as simply one element of the total instructional configuration. Although these examinations influence acquisition, we do not believe this influence to be uniform for all students under all classroom conditions. Furthermore, we do not believe this influence is always exerted in a positive direction. Thus whereas acquisition is facilitated when students are administered the "right" kind of examination, acquisition can be impeded by administering the "wrong" kind of examination.

Whether or not an examination is "right" or "wrong" is largely an idiosyncratic matter. The "right" kind of examination for one student may well be "wrong" for another. Thus from our perspective, and taking into account our empirical findings, acquisition is shaped not by the examination content as objectively defined, but by the appropriateness of that content for the learner in question.

Determinants of "Appropriateness"

The appropriateness of different examination contents for different kinds of learners has already been discussed (Chapters 10 and 11) as a function of ability-linked and set-linked drive patterns. We will not present additional hypotheses or data in the present discussion. Instead we will bring together here several formerly isolated statements about the role of course examination content.

In general we have said that an appropriate examination is one that (a) provides an appropriate intellectual challenge for the student, and (b) is congruent with his educational set. The bulk of our evidence supports the view that course examinations which are appropriate by these criteria stimulate acquisition, and that the shaping effect of the examination content is secondary. In other words, factually oriented examinations may encourage factual over conceptual acquisition only for those students for whom factual examinations are appropriate. If factually oriented examinations are inappropriate for the student in question, they either will have no effect or a negative effect upon factual acquisition. The same type of generalization holds for conceptually oriented course examinations.

Intellectual Challenge

The intellectual challenges provided by classroom experiences, including course examinations, and the appropriateness of these challenges as a function of academic ability, were discussed in Chapter 10. In that discussion we hypothesized that the brighter students perform best when intellectually challenged or stimulated by the classroom environment; less bright students perform best when "protected" by the classroom environment.

In terms of these hypotheses, course examinations may be either appropriately challenging or inappropriately easy for the brighter students. Likewise they may be appropriately challenging or threat-inducing (because they are too difficult) for the less bright students.

A first approximation to the appropriateness of the intellectual challenge provided by course examinations as a function of ability is given in Figure 16-1.

Figure 16-1
Perceived Levels of Difficulty of Examination Content as a Function of Academic Ability

Ability of Student	Examination Content Emphasizing	
	Conceptual Acquisition	Factual Acquisition
High Ability	Appropriate Challenge	Too Easy
Low Ability	Too Difficult	Appropriate Challenge

Figure 16-1 predicts that criterion performance for high ability students will be facilitated when they are given conceptually oriented course examinations are inhibited when they are given factually oriented course examinations. The converse is predicted by Figure 16-1 for low ability students.

These predictions can be refined somewhat by invoking the concept of instructional press (Chapter 9). The facilitative effects predicted from Figure 16-1 are most likely to be evident when the press is intrinsic; the inhibitory effects are most likely to be evident when the press is extrinsic. The effects of examination content as a dual function of ability and instructional press are summarized in Figure 16-2.

Figure 16-2
Hypothesized Effects Upon Performance of Course Examination Content, Academic Ability, and Instructional Press

Instructional Press	Examination Content	Effect Upon Performance By	
		High Ability Students	Low Ability Students
Intrinsic	Conceptual	Facilitate	No Effect
	Factual	No Effect	Facilitate
Extrinsic	Conceptual	No Effect	Inhibit
	Factual	Inhibit	No Effect

Congruence of Examination Content and Educational Set

In the discussion of set-linked drive patterns (Chapter 11) we hypothesized, given an extrinsic instructional press, that educational performance is optimized when the examination content and the student's educational set are congruent. We also hypothesized, in that same discussion, that congruence between examination content and educational set is irrelevant when the instructional press is intrinsic. Given an intrinsic press, performance is facilitated by a conceptual set and inhibited by a factual set regardless of the examination content.

These effects are summarized in Figure 16-3.

Figure 16-3
Hypothesized Effects Upon Performance of Course Examination Content, Educational Set, and Instructional Press

Instructional Press	Examination Content	Effect Upon Performance By	
		Conceptually Set Students	Factually Set Students
Intrinsic	Conceptual	Facilitate	Facilitate
	Factual	Inhibit	Inhibit
Extrinsic	Conceptual	Facilitate	Inhibit
	Factual	Inhibit	Facilitate

A Synthesis

The predicted effects of course examination content taking into account the instructional press, the student's set, and the student's level of academic ability are synthesized in Figure 16-4. The entries for this figure are an amalgamation of the entries in Figures 16-2 and 16-3.

Figure 16-4
Hypothesized Effects Upon Performance of Course Examination Content, Educational Set, Academic Ability, and Instructional Press

Instructional Press	Type of Student		Effect of Course Examinations with	
	Ability	Set	Conceptual Orientation	Fact Orientation
Intrinsic	High	Conceptual	Facilitating	Mildly Inhibiting
		Factual	Facilitating	Mildly Inhibiting
	Low	Conceptual	Mildly Facilitating	No Effect
		Factual	Mildly Facilitating	No Effect
Extrinsic	High	Conceptual	Mildly Facilitating	Inhibiting
		Factual	Mildly Inhibiting	No Effect
	Low	Conceptual	No Effect	Mildly Inhibiting
		Factual	Inhibiting	Mildly Facilitating

To construct Figure 16-4 it was necessary to make some assumption about the relative strengths of ability-linked and set-linked drives. In the absence of empirical data on this point, we assumed they were equally strong. Thus in the synthesis a facilitating effect attributed to either the ability- or set-linked drive pattern is treated as canceling an inhibiting effect attributed to the other of the two drive patterns.

The effects summarized in Figure 16-4 are translated into anticipated performance levels relative to the means of the high and low ability subgroups in Figure 16-5.

Figure 16-5
Performance Levels Predicted for Various Ability x Set Subgroups
As A Dual Function of Instructional Press and Course Examination Content
(Argument is the mean of the two ability subgroups)*

Instructional Press	Type of Student		Examination Content	
	Academic Ability	Educational Set	Conceptual Orientation	Factual Orientation
Intrinsic	High	Conceptual	$> M_H$	$\not< M_H$
		Factual	$> M_H$	$\not< M_H$
	Low	Conceptual	$\not> M_L$	M_L
		Factual	$\not> M_L$	M_L
Extrinsic	High	Conceptual	$\not> M_H$	$< M_H$
		Factual	$\not< M_H$	M_H
	Low	Conceptual	M_L	$\not< M_L$
		Factual	$< M_L$	$\not> M_L$

* The entries $>$ and $<$ designate respectively anticipated performance considerably above and considerably below the mean; the entries $\not>$ and $\not<$ designate respectively anticipated performance slightly above and slightly below the mean.

Figure 16-5 is only crudely quantitative; the magnitudes of predicted elevations or depressions of performance with reference to the means are expressed in the terms "considerably above (or below)," "slightly above (or below)," and "equal to." Thus the predicted effects must be taken suggestively rather than literally. They show anticipated directions of performance and rough approximations of magnitudes.

Because of the gross nature of the quantifications, the predicted patterns for the ability subgroups do not balance. In order to help overcome this difficulty, the performance levels predicted in Figure 16-5 are translated in Figure 16-6 making reference to the mean of the total group rather than to the means of the ability subgroups. This translation was facilitated by knowing that $M_H > M_T$ and $M_L < M_T$; and by assuming that $\nless M_H = \ngtr M_L = M_T$.

Figure 16-6
Performance Levels Predicted for Various Ability x Set Subgroups
As A Dual Function of Instructional Press and Course Examination Content
(Argument is mean of the total group)

Instructional Press	Type of Student		Examination Content	
	Academic Ability	Educational Set	Conceptual Orientation	Factual Orientation
Intrinsic	High	Conceptual	$>M$	M
		Factual	$>M$	M
	Low	Conceptual	M	$<M$
		Factual	M	$<M$
Extrinsic	High	Conceptual	$>M$	M
		Factual	M	$>M$
	Low	Conceptual	$<M$	$<M$
		Factual	$<M$	M

Although the transformation made in Figure 16-6 using the mean of the total group as the referrent achieves balance under conditions of an intrinsic instructional press, it fails somewhat to do so for courses providing an extrinsic press. In spite of this minor difficulty, Figure 16-6 approximates the predicted performance patterns following the rationale provided by the concepts of instructional press and idiosyncratic drive patterns.

The interaction critical to the verification of Figure 16-6 is, of course, the one designated Ab x S x O. It is important to note that Figure 16-6 predicts that this interaction cannot be statistically significant in courses providing an intrinsic instructional press. This figure also predicts that the interaction may be significant in courses providing an extrinsic instructional press.

The Data

The Ab x S x O interactions to be compared with Figure 16-6 were all presented earlier. The significance levels of these interactions and the circumstances under which each was obtained are repeated for convenience in Table 16-1.

Table 16-1
Significance Levels of Obtained Ab x S x O Interactions

		Course (and Instructional Press)				
Interaction	Acquisition Criterion	Educ. Psych. (mixed)	Zoology (intrinsic)	Physiology (extrinsic)	Business Psychology (mildly intrinsic)	Shakespeare (mildly extrinsic)
Ab x S x O	Factual	ns	ns	ns	ns	.01
	Conceptual	ns	ns	.10	ns	ns
Ab x S x O x Pr	Factual	ns	ns	.05	*	*
	Conceptual	ns	ns	ns	*	*
Ab x S x O x Con	Factual	ns	ns	.05	*	*
	Conceptual	ns	ns	.01	*	*
Ab x S x O x Mot	Factual	ns	ns	ns	*	*
	Conceptual	ns	ns	ns	*	*

* Interactions not tested

None of the Ab x S x O interactions shown in Table 16-1 attained statistical significance in courses with a clearly intrinsic instructional press (Zoology) or a moderately intrinsic press (Business Psychology). This is as predicted in Figure 16-6. The addition to this basic interaction of a fourth variable likewise failed to produce significant interactions when the press was either clearly or mildly intrinsic.

Figure 16-6 also predicts that significant interactions are possible only when the press is extrinsic. Such a press was clearly evident in Physiology and perhaps also in Shakespeare. As anticipated, these were the only courses wherein statistically significant F-ratios were obtained.

The patterns of subgroup means are summarized for the two significant Ab x S x O interactions (disregarding interactions involving a fourth variable) in Table 16-2. The entries in this table are mean deviations (mean of the total group minus the subgroup mean) to facilitate comparison with the patterns predicted in Figure 16-6.

Table 16-2
Patterns of Interaction Ab x S x O
When F-Ratio is Statistically Significant*

Course	Criterion	Student Characteristics		Examination Content	
		Ab	S	Conceptual O	Factual O
Shakespeare	Factual Acquisition	High Ab	Conc. S	+ 8.6	+ 1.5
			Fact. S	- 3.0	+ 8.0
		Low Ab	Conc. S	-10.7	+ 3.5
			Fact. S	- 8.4	+ 0.4
Physiology	Conceptual Acquisition	High Ab	Conc. S	+ 4.8	+ 1.7
			Fact. S	- 0.1	+ 1.5
		Low Ab	Conc. S	- 2.1	- 2.2
			Fact. S	- 1.5	- 2.7

* Entries are mean deviations (mean of the total group minus subgroup means).

In spite of certain discrepancies between the predicted and obtained subgroup patterns for this interaction, the pattern predicted in Figure 16-6 for an extrinsic press approximates the obtained pattern more closely than any other pattern that could have been constructed.

Although the patterns for the third-order interactions (Ab x S x O x one additional variable) are not shown, the obtained relationships conform more closely to the predicted ones when students were denied contact with the instructor and when they were proctored. Special circumstances surrounding the contact and proctor variables in this course and perhaps accounting for this fact were noted earlier.

Conclusion

There has been widespread speculation that because of the dependence of grades upon examination performance, the content of examinations acts to determine the focus of acquisition by students. Briefly stated, there is substantial support for the view that students attempt to learn whatever they think their instructor regards as important.

Another view of the role of examination content, favored in the present investigation, emphasizes that course examinations are just one element of the total instructional environment. As such they act primarily to stimulate or depress the level of acquisition and only secondarily as focusing agents. The power of conceptually vs. factually oriented course examinations is regarded mainly as a function of the appropriateness of each of these types of content for the individual student.

Whereas conceptual examinations are most appropriate for certain students, factual examinations are most appropriate for others. Administration of appropriate examinations stimulates academic performance; administration of inappropriate examinations either has no effect upon academic performance or causes a performance decrement.

Two of the determinants of appropriateness of examination content are the student's academic ability and his educational set. Generally speaking, conceptually oriented examinations are most appropriate for conceptually set, high ability students whereas factually oriented examinations are most appropriate for factually set, low ability students. The consistent administration throughout the semester of examinations with appropriate contents is seen as a potential performance stimulator. Likewise the consistent administration of examinations with inappropriate contents is seen as a potential performance inhibitor.

Whether or not potentially stimulating and inhibiting effects are actually important depends upon the instructional press prevailing in the course. Courses providing an intrinsic press sensitize students to potential performance stimulators; courses providing an extrinsic press sensitizes students to potential performance inhibitors.

Instructors tend generally to believe that they can encourage all students to conceptualize about the subject by requiring this behavior on their examinations. Actually the only type of student for whom conceptually oriented examination content is clearly beneficial regardless of the instructional press is the one with high ability who is conceptually set. Aside from this special circumstance, we regard the power of examination content alone for shaping acquisition as minor. The examinations may not be at all effective for this purpose and, in fact, may encourage the opposite of the desired outcome unless they are appropriate to the student's needs and abilities and are buttressed by an appropriate instructional press.

References

McKeachie, W. J. "Procedures and techniques of teaching: A summary of experimental studies." In N. Sanford, The American College. John Wiley & Sons, Inc., N.Y., 1962, p. 314.

CHAPTER 17

RELEVANCE OF THINKING

The rationale and procedure for assessing relevance of thinking as an educational criterion were presented in Chapter 6. The point was made that although end-of-course acquisition measures are commonly used as research criteria, these may be contaminated by extra-class circumstances. Since relevance of thinking, on the other hand, does not contribute directly to course grades or fulfillment of graduation requirements it is therefore likely to be uniquely sensitive to the influence of certain classroom conditions and learner characteristics.

Although data have consistently been presented throughout this Report for both types of criteria, the discussions, generalizations, and conclusions have not required that these criteria be differentiated. Chapter 17 is limited to a consideration of some of the determinants of relevant thinking. In particular our data are re-examined to provide evidence for (a) the unique sensitivity of relevance of thinking, rather than end-of-course acquisition, to certain learner characteristics; (b) the sensitivity of this criterion also to circumstances that facilitate the learner's attentiveness during the lecture presentation.

Following this re-examination of the data, we propose a hypothetical set of intrinsic requirements for relevant thinking during class meetings. These hypothesized relationships were untested; they suggest a direction for subsequent research.

Learner Characteristics

Rationale

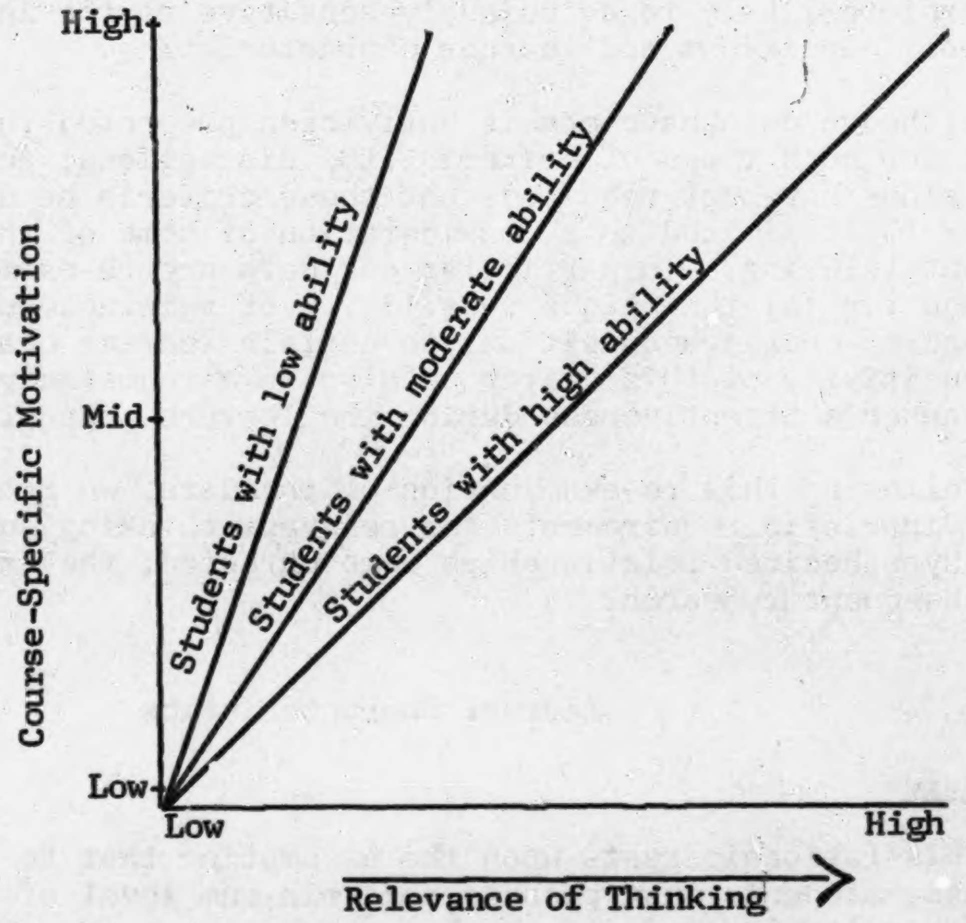
This rationale rests upon the assumption that to think most relevantly in class, students must possess some minimum level of academic ability. Below this level, students may be attentive but are ordinarily so preoccupied with attempting simply to comprehend the lecture content that they are unable to manipulate this content as required to earn a high thought relevance score.

Assuming a student has the requisite minimum level of academic ability signifying potential for relevant thinking, course-specific motivation determines whether this potential is maximally utilized.

Our expectation about the roles of motivation and academic ability as joint determinants of relevant thinking is schematically shown in

Figure 17-1. A high level of motivation is hypothesized as a critical requirement for relevant thinking. However since we made the assumption that low ability students do not possess the prerequisite cognitive potential for highly relevant thinking, the role of course-specific motivation should be apparent in interaction with academic ability rather than as a main effect. The difference in level of thought relevance favoring highly over poorly motivated students should thus be more apparent for high than for low ability students.

Figure 17-1
Hypothesized Levels of Thought Relevance as a Function of Ab x Mot


High
Mid
Low
Course-Specific Motivation
Students with low ability
Students with moderate ability
Students with high ability
Low
High
Relevance of Thinking

The Data

The foregoing rationale focuses attention upon the Ab x Mot interaction. The significance levels of obtained findings for this interaction in the survey courses are reiterated in Table 17-1. (The reason for restricting this summary to the survey courses is that the distributions of both academic ability and motivation were curtailed in the two advanced courses.)

Table 17-1
Significance Levels of Ab x Mot

Course	Criterion Factual Acquisition	Conceptual Acquisition	Relevance
Educational Psychology	ns	ns	.10
Zoology (61-62)	ns	ns	ns
Zoology (62-63)	ns	ns	ns
Physiology	ns	ns	.10

As shown in Table 17-1, the relevance measure was more sensitive to the interaction Ab x Mot than was either of the acquisition measures. The interaction pattern in particular for Educational Psychology was as predicted from the rationale: i.e., highly motivated high ability students thought more relevantly than poorly motivated high ability students.

Environmental Manipulations

Rationale

One of the environmental manipulations--presence or absence of a proctor--was expected *a priori* to affect the Ab x Mot interaction. The proctor's role was to maintain discipline, making it possible for students who wished to do so to attend to and think about the lecture with a minimum of distraction. Students in unproctored sections were entirely "on their own."

We anticipated that in the absence of a proctor, the student's behavior would be very much a function of his intrinsic characteristics. Thus we expected the basic Ab x Mot interaction described in the preceding section to hold. However in proctored sections we expected that this interaction would change. This expectation rested upon what we perceived to be the special suitability of the proctored condition as a compensating factor for low ability but highly motivated students. These are the students who most needed insulation from distractions during class.

The predictions about the Ab x Mot interaction without regard for the proctor as a variable are contrasted in *Figure 17-2* with the parallel predictions for Ab x Mot x Pr.

Figure 17-2
Predictions: Ab x Mot; Criterion is Relevance of Thinking

A. Without Regard for the Variable, Proctor

	High Ab	Low Ab
High Mot	$>M_h$	M_l
Low Mot	$<M_h$	M_l

B. In Interaction with the Variable, Proctor

		High Ab	Low Ab
Pr	High Mot	M_h	$>M_l$
	Low Mot	M_h	$<M_l$
No Pr	High Mot	$>M_h$	M_l
	Low Mot	$<M_h$	M_l

The Data

For the criterion relevance of thinking, we have already noted that Ab x Mot was statistically significant as predicted by Figure 17-2A in Educational Psychology and in Physiology.

Pr x Mot x Ab was statistically significant in Zoology whereas the addition of a fourth variable, Prior Knowledge, generated significant PK X Pr x Mot x Ab interactions in Educational Psychology and Physiology.

The subgroup means for these interactions are summarized in Table 17-2.

Note that although the patterns displayed in Table 17-2 do not correspond exactly to those predicted by Figure 17-2, they are approximate fits for the interactions Mot x Ab and Pr x Mot x Ab. Note also that the predicted patterns are approximated somewhat more closely under the condition of low rather than high prior knowledge.

Table 17-2

Subgroup Patterns For Statistically Significant Mot x Ab Interactions*

Interaction	Course	Interacting Variables			Ability Level	
					High Ab	Low Ab
Mot x Ab	Educational Psychology			High Mot	+.25	+.06
				Low Mot	-.25	-.06
Mot x Ab	Physiology			High Mot	+.13	-.16
				Low Mot	-.13	+.16
Pr x Mot x Ab	Zoology		Pr	High Mot	-.40	+.34
				Low Mot	+.30	-.76
			No Pr	High Mot	+.41	+.13
				Low Mot	-.32	+.35
PK x Pr x Mot x Ab	Educational Psychology	High PK	Pr	High Mot	+.57	-.18
				Low Mot	-.41	+.33
			No Pr	High Mot	+.22	-.03
				Low Mot	-.25	+.44
		Low PK	Pr	High Mot	+.05	+.36
				Low Mot	+.06	-.62
			No Pr	High Mot	+.19	-.39
				Low Mot	-.59	+.05
PK x Pr x Mot x Ab	Physiology	High PK	Pr	High Mot	+.78	+.31
				Low Mot	+.23	+.76
			No Pr	High Mot	00	-.31
				Low Mot	-.38	-.10
		Low PK	Pr	High Mot	+.29	+.31
				Low Mot	+.55	-.14
			No Pr	High Mot	-.55	-.94
				Low Mot	-.95	+.11

* All entries are Z-score conversions of subgroup means calculated by subtracting the interaction subgroup mean from the mean of the appropriate ability subgroup and dividing by the standard deviation of the ability subgroup.

Conclusion

These data confirm the dependence of relevant thinking upon motivation and academic ability. In particular, whereas high ability predisposes more relevant thinking than does low ability, course specific motivation seems to be a partial determinant of whether this predisposition will be utilized.

Certain environmental circumstances may play a secondary role as partial determinants of relevant thinking. In TV courses, for example, the presence of a proctor may encourage relevant thinking from students who are not intrinsically disposed to think relevantly.

These conclusions are approximations. Judging from the data patterns displayed in Table 17-2 and the fact that these do not correspond as closely as we might wish to patterns predicted from the hypothesized interaction of academic ability and motivation, we must hypothesize further about the roles of other intrinsic characteristics as partial determinants of relevant thinking.

Intrinsic Requirements for Relevant Thinking

The balance of this discussion is entirely speculative and unsupported by data. Its purpose is to present a rationale concerning intrinsic prerequisites to relevant thinking. Although this rationale is amenable to empirical test, the pertinent data were not available from the present series of studies.

A number of writers have distinguished between different "cognitive styles" reflected in parallel perceptual processes, learning strategies and educational sets. In his work on cognitive abilities, for example, Guilford distinguishes between convergent and divergent (creative) abilities. In a related vein other authors distinguish between "discrete" and "contextual" perceptual processes and/or learning strategies. In our own work, we speak of factual and conceptual educational sets.

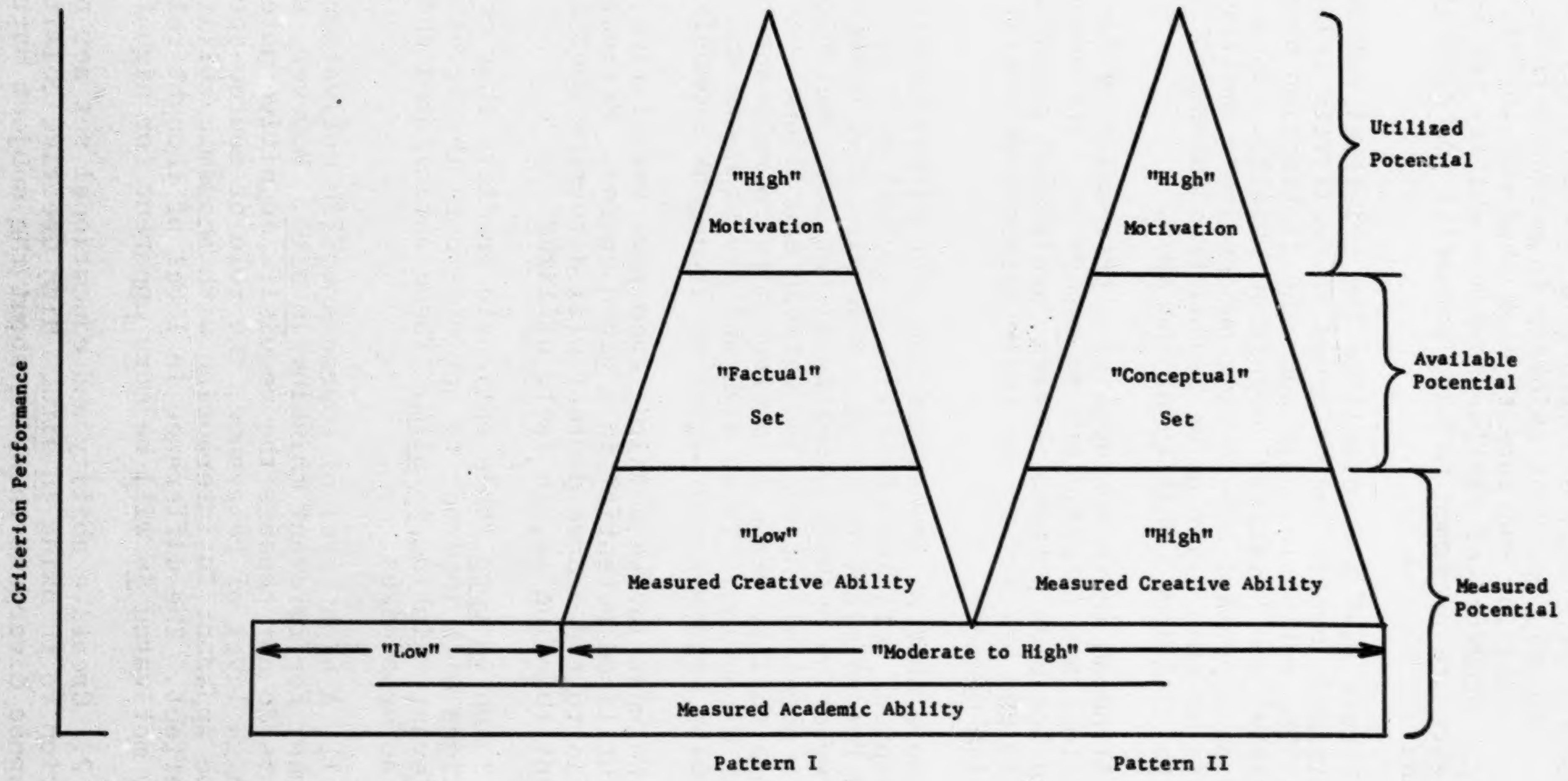
The distinctions above have clear implications for the character of thinking by students during class presentations. We infer that of those students who do think relevantly, some will think convergently (or discretely) and others will think divergently (or conceptually). And we hypothesize that the intrinsic characteristics of these two types of relevant thinkers will differ.

We have already discussed the dependence of relevant thinking upon two learner characteristics: academic ability and motivation. We speculate that two additional characteristics, creative ability and educational set, determine the direction taken by the student's relevant thinking. The hypothesized influence of these four learner characteristics is shown schematically in Figure 17-3 and discussed below.

As shown in this Figure, if we assume that a student has the requisite minimum level of academic ability, and consequent potential for relevant thinking, this potential may be organized in one of two

FIGURE 17-3

Intrinsic Conditions Facilitating Relevant Thinking In Class


Criterion Performance
"High"
Motivation
"Factual"
Set
"Low"
Measured Creative Ability
"High"
Motivation
"Conceptual"
Set
"High"
Measured Creative Ability
Utilized Potential
Available Potential
Measured Potential
"Low"
"Moderate to High"
Measured Academic Ability
Pattern I
Pattern II

patterns. These patterns are assumed to correspond to potential for convergent (Pattern I) and divergent (Pattern II) thinking. Potential for convergently relevant thinking is presumed to be characteristic of students combining moderate to high academic ability with low creative ability. Students of similar academic ability but with high measured creativity are presumed to have potential for divergently relevant thinking.

Figure 17-3 also clarifies the tri-level nature of the rationale for intrinsic conditions believed to facilitate relevant thinking in class. The rationale rests upon the distinction between "measured," "available" and "utilized" cognitive ability. These three levels are viewed as pyramidal layers with successively smaller proportions of students at each layer as we ascend from "measured" ability at the base to "utilized" ability at the apex.

Although there are cognitive prerequisites for relevant thinking, these alone are insufficient to assure it. The second level of the pyramid for each pattern showing "available" potential represents those students who are set to use their measured potential in an educationally effective manner.

Note that we are suggesting that either combination (high creativity x conceptual set; low creativity x factual set) provides a cognitive background for relevant thinking. Note also that whereas we have postulated an interaction between educational set and creativity, we have not postulated a parallel interaction between educational set and academic ability. Academic ability alone is prerequisite to relevant thinking, but does not give it direction. Those high ability students who think relevantly may do so with either a convergent or divergent emphasis.

We must invoke a third, even more restrictive, level when we consider utilized potential in a given course. Motivation and interest specific to the course content will determine whether the potential for relevant thinking is, in fact, utilized.

Taken *in toto*, this rationale predicts that certain intrinsic conditions will interact to optimize both the level and contentual focus of relevant thinking *in situ*. These anticipated interactions are stated below as hypotheses.

1. A high level of course-specific motivation is a critical requirement for relevant thinking *in situ*. However, since low ability students do not possess the requisite cognitive potential for thinking at a high level of relevance, the role of course-specific motivation will be apparent in interaction with academic ability rather than as a main effect. The difference in level of thought relevance favoring highly motivated *S*s will be more apparent for high than low ability *S*s.

2. Creative ability and educational set act primarily to give direction to thinking *in situ*. High creative ability and conceptual set predispose divergent thinking about the subject matter; low creative ability and factual set predispose convergent thinking about the subject matter.

The efficacy of either creativity or educational set is contingent upon the other. Directional confluence evidenced either by the combination high creativity x conceptual set or low creativity x factual set will predispose a high level of thought relevance. Conversely, directional dissonance (high creativity x factual set or low creativity x conceptual set) will dissipate cognitive energies and be reflected in a relatively low level of thought relevance.

APPENDIX A

A-1. The Educational Set Scale.

A-2. Scoring Key for the Educational Set Scale.

A-3. Percentile Equivalents of Raw Scores in Five Televised Courses.

APPENDIX A-1.

EDUCATIONAL SET SCALE

We have selected several courses in which large numbers of students tend to enroll. For each course we have listed a variety of topics covered, items of information presented, and tasks to be accomplished.

Assume that you are enrolled in these courses and therefore are required to learn about each of the topics listed on the following pages.

The topics are listed in groups of three. Decide which one of the three topics in each group would interest you most and which one would interest you least. Rank the topics in each set of three indicating the extent to which each one interests you by assigning

1. **to the topic that interests you MOST**
2. **to the topic in which you have an intermediate interest**
3. **to the topic that interests you LEAST**

You may not omit a rank for any topic or assign the same rank to two topics within a set. Although it may sometimes be difficult for you to make a decision, it is imperative that you do so by assigning ranks of 1, 2, and 3 to the topics listed in each set.

Examples:

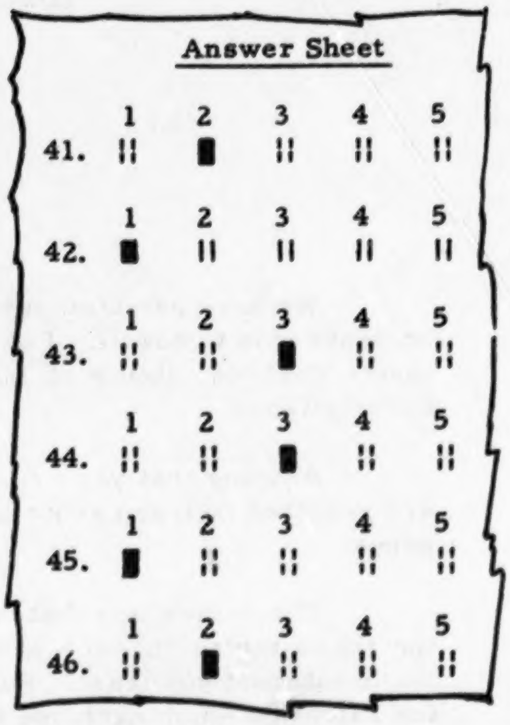
Assume you are enrolled in a GEOGRAPHY course and must learn about the following:

A. Items 41 - 43

41. **The causes of earthquakes.**
42. **The names of the world's major oceans.**
43. **The distinction between anthracite and bituminous coal.**

B. Items 44 - 46

44. **The length of the Panama Canal.**
45. **The influence of terrain upon farming procedures.**
46. **The location of major United States timber resources.**



Answer Sheet

	1	2	3	4	5
41.	¦¦	■	¦¦	¦¦	¦¦
42.	■	¦¦	¦¦	¦¦	¦¦
43.	¦¦	¦¦	■	¦¦	¦¦
44.	¦¦	¦¦	■	¦¦	¦¦
45.	■	¦¦	¦¦	¦¦	¦¦
46.	¦¦	■	¦¦	¦¦	¦¦

This person has marked his answer sheet for two sets of topics. He has indicated that, of the three topics in Set A, he is most interested in 42 ("names of the world's major oceans"); least interested in 43 ("distinction between anthracite and bituminous coal"); and has an intermediate interest in 41 ("causes of earthquakes"). Of the three topics in Set B, he is most interested in 45, least interested in 44, and has an intermediate interest in 46.

Note: Although the answer sheet has 5 answer positions, you are to use only positions 1, 2, and 3 to rank the three topics in each set.

Remember also that you must rank every topic in the set and you cannot assign the same rank to any two topics.

KEY:
1 - MOST interest in this topic
2 - Intermediate interest in this topic
3 - LEAST interest in this topic

****

Assume you are enrolled in a GEOGRAPHY course and must learn about the following:

A. Items 1 - 3

1. The factors responsible for westward population migration in the U. S.
2. The names of the capitals of the European countries.
3. The names and locations of the 10 largest rivers in the world.

B. Items 4 - 6

4. The average annual per capita consumption of petroleum products in the U. S.
5. The definitions of loess, mesas, drumlins, lithosphere, playas, and biosphere.
6. Requisites for artesian well systems.

C. Items 7 - 9

7. How artesian wells are formed.
8. Forecasts about the weather to be expected in New York City during the next 48 hours from examination of a weather map.
9. The chemical composition of lava.

D. Items 10 - 12

10. The meaning of "cold," "warm," "occluded," and "cyclonic" fronts.
11. The five major world producers (in order of importance) of iron, lead, zinc, and copper.
12. The role of seaports in national economy.

E. Items 13 - 15

13. The factors considered by geologists in attempting to locate oil deposits.
14. Statistics on the average family size for each socioeconomic subgroup.
15. Population shifts in the United States during the past 50 years.

F. Items 16 - 18

16. The names of the world's major glacial areas.
17. The influence of terrain upon agricultural crops.
18. The route taken by the St. Lawrence Seaway.

(Go Right On To The Next Page)

KEY:

1 - MOST interest in this topic
2 - Intermediate interest in this topic
3 - LEAST interest in this topic

****

Assume you are enrolled in a SOCIAL SCIENCE course and must learn about the following:

A. Items 19 - 21

19. Environment as a partial determinant of mental illness.
20. The relationship between I. Q. and scholastic success in a college or university.
21. Average ages at which children first begin to creep, walk, identify colors, etc.

B. Items 22 - 24

22. The difference between a psychiatrist, a psychologist, and a psychoanalyst.
23. The percentage of youngsters apprehended as juvenile delinquents who subsequently are apprehended by the law for committing a major crime.
24. The role of psychological testing in vocational guidance.

C. Items 25 - 27

25. The proportion of United States residents now over age 65.
26. The effects of caffeine upon muscular coordination.
27. The meaning of "percentile" in interpreting test results.

D. Items 28 - 30

28. The primary symptoms differentiating psychotic (insane) behavior from neurotic behavior.
29. The specific human capabilities known to deteriorate after about age 60.
30. The average incomes of various classifications of workers in the U. S. (e. g., unskilled, semiskilled, technical, professional, etc.)

E. Items 31 - 33

31. The percentage of family income that ought to be budgeted for rent, food, clothing, recreation, etc.
32. What it is that the psychoanalyst attempts to do.
33. The current divorce rate in the United States.

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KEY:

1 - **MOST interest in this topic**
2 - **Intermediate interest in this topic**
3 - **LEAST interest in this topic**

****

Assume you are enrolled in a BUSINESS & ECONOMICS course and must learn about the following:

A. Items 34 - 36

34. **The functions of the Securities and Exchange Commission.**
35. **Factors operating to diminish the size of the U.S. gold reserve.**
36. **Why an "easy money" policy may be unsound public policy.**

B. Items 37 - 39

37. **The names of the components of the "Gross National Product."**
38. **The meaning of an "odd lot" in stock purchases.**
39. **The purpose underlying agricultural price supports.**

C. Items 40 - 42

40. **Major events in the growth of U.S. labor unions.**
41. **The names of the nations constituting the "common market."**
42. **Factors underlying a decision to invest vs. a decision to save.**

D. Items 43 - 45

43. **The name of an inflationary potential in the economy which is artificially kept from registering itself in prices.**
44. **The relationship between disposable incomes and total expenditures for consumer goods.**
45. **The ways in which Federal Reserve monetary policy attempts to accomplish its goals.**

E. Items 46 - 48

46. **How to read entries in the stock market page of a newspaper.**
47. **The present established worth of an ounce of gold.**
48. **What is meant by a "holding company."**

(Go Right On To The Next Page)

KEY:

1 - MOST interest in this topic
2 - Intermediate interest in this topic
3 - LEAST interest in this topic

****

Assume you are enrolled in a GOVERNMENT course and must learn about the following:

A. Items 49 - 51

49. The uses of international law in government.
50. The steps involved in amending the United States Constitution.
51. The functions of the Federal Communications Commission (FCC).

B. Items 52 - 54

52. The causes of the Cuban crisis.
53. The reasons for official U.S. opposition to recognizing Red China.
54. Comparative armed strength of the U.S. and Russia.

C. Items 55 - 57

55. Pros and cons of alternative solutions to U.S. housing problems.
56. Consequences of technological unification of the world.
57. A statement of the Marxist theory of history.

D. Items 58 - 60

58. The functions of the Central Intelligence Agency.
59. The estimated annual cost to the U.S. of the "cold war."
60. The pressures operating to produce European unity and disunity.

E. Items 61 - 63

61. Differences in the social and economic characteristics of midwestern republicans and democrats.
62. The limits of authority of a Justice of the Peace.
63. The names and dates of office of the U.S. presidents.

F. Items 64 - 66

64. The ways in which states are admitted to the Western State System.
65. The meaning of government to John Locke.
66. The name of the international organization conducting surveys of the world food situation.

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KEY:

1 - MOST interest in this topic
2 - Intermediate interest in this topic
3 - LEAST interest in this topic

****

Assume you are enrolled in a NATURAL SCIENCE course and must learn about the following:

A. Items 67 - 69

67. The explanation for the fact that it is sometimes difficult to recognize voices on the telephone.
68. The distances from earth to the other planets in our galaxy.
69. The critical velocity required to escape the earth's gravitational pull.

B. Items 70 - 72

70. The names of the elements included within the "halide" group.
71. Statement of Newton's third law of motion.
72. The significance of a pH of 6.

C. Items 73 - 75

73. Formula for converting centigrade temperature readings to fahrenheit readings.
74. The difference in chemical structure between H_2O (water) and H_2O_2 (hydrogen peroxide).
75. The distinction between "anode" and "cathode."

D. Items 76 - 78

76. Chemical factors associated with transmitting neural impulses.
77. Why thrust is generated by a jet engine.
78. The chemical structure of penicillin.

E. Items 79 - 81

79. The relative conductivity of certain substances (e.g., iron, copper, zinc, wood).
80. The meaning of "specific gravity."
81. The effect of increased pressure upon the boiling point of a liquid.

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KEY:

1 - MOST interest in this topic
2 - Intermediate interest in this topic
3 - LEAST interest in this topic

****

Assume you are enrolled in an ENGLISH course and must learn about or do the following:

A. Items 82 - 84

82. Write a report on the novel entitled 1984.
83. The names of Shakespeare's comedies.
84. The reason why Hedda Gabler (in Ibsen's Hedda Gabler) kills herself.

B. Items 85 - 87

85. The names of 10 contemporary authors and their most important works.
86. Write a biographical sketch based upon library research of any author (no longer living) of your choice.
87. The effects of 19th century American history upon the American literature of the period.

C. Items 88 - 90

88. The elements in a play that lead to its classification as a "tragedy."
89. The correct spelling for the word meaning "to pay" (i.e., is it "renumerate" or "remunerate").
90. Write a theme about the most interesting person you have ever met.

D. Items 91 - 93

91. The dates and major works of well-known poets like Whitman, Longfellow, Wordsworth, etc.
92. The role of the playwright in contemporary society.
93. The structure (i.e., number of lines, rhyming schemes, etc.) of sonnets.

APPENDIX A-2

Scoring Key for the Educational Set Scale

Scoring Formula: R-W

	Alternative				Alternative				Alternative				Alternative		
Item	A	B	C	Item	A	B	C	Item	A	B	C	Item	A	B	C
1	+	0	-	31	0	0	0	61	+	0	-	91	-	0	+
2	0	0	0	32	+	0	-	62	0	0	0	92	+	0	-
3	-	0	+	33	-	0	+	63	-	0	+	93	0	0	0
4	-	0	+	34	-	0	+	64	0	0	0				
5	0	0	0	35	0	0	0	65	+	0	-				
6	+	0	-	36	+	0	-	66	-	0	+				
7	0	0	0	37	-	0	+	67	+	0	-				
8	+	0	-	38	0	0	0	68	-	0	+				
9	-	0	+	39	+	0	-	69	0	0	0				
10	0	0	0	40	0	0	0	70	-	0	+				
11	-	0	+	41	-	0	+	71	0	0	0				
12	+	0	-	42	+	0	-	72	+	0	-				
13	+	0	-	43	-	0	+	73	0	0	0				
14	-	0	+	44	+	0	-	74	+	0	-				
15	0	0	0	45	0	0	0	75	-	0	+				
16	-	0	+	46	+	0	-	76	0	0	0				
17	+	0	-	47	-	0	+	77	+	0	-				
18	0	0	0	48	0	0	0	78	-	0	+				
19	+	0	-	49	+	0	-	79	0	0	0				
20	0	0	0	50	-	0	+	80	-	0	+				
21	-	0	+	51	0	0	0	81	+	0	-				
22	0	0	0	52	+	0	-	82	0	0	0				
23	-	0	+	53	0	0	0	83	-	0	+				
24	+	0	-	54	-	0	+	84	+	0	-				
25	-	0	+	55	0	0	0	85	-	0	+				
26	+	0	-	56	+	0	-	86	0	0	0				
27	0	0	0	57	-	0	+	87	+	0	-				
28	+	0	-	58	0	0	0	88	+	0	-				
29	0	0	0	59	-	0	+	89	-	0	+				
30	-	0	+	60	+	0	-	90	0	0	0				

APPENDIX A-3

Percentile Equivalents of Raw Scores in Five Courses

Raw Score	Educational Psych. (N=337)	Physiology (N=357)	Zoology (N=504)	Business Psych. (N=55)	Shakespeare (N=71)	Raw Score
50: 52				99		50: 52
47: 49				98	99	47: 49
44: 46				96	96	44: 46
41: 43		99	99	95	93	41: 43
38: 40	99			93	92	38: 40
35: 37		98	97	87	85	35: 37
32: 34			96	82	79	32: 34
29: 31	98	94	94	78	72	29: 31
26: 28	94	91	92	75	68	26: 28
23: 25	90	87	88	69	61	23: 25
20: 22	85	81	82	62	55	20: 22
17: 19	78	77	74	42	42	17: 19
14: 16	70	71	67	35	32	14: 16
11: 13	64	64	61	24	27	11: 13
8: 10	52	52	53	16	18	8: 10
5: 7	42	42	43	11	13	5: 7
2: 4	34	32	33	05	11	2: 4
- 1:+ 1	23	25	25	05	06	- 1:+ 1
- 4:- 2	16	18	16	05	04	- 4:- 2
- 7:- 5	10	12	11	04	04	- 7:- 5
-10:- 8	07	07	07	02	04	-10:- 8
-13:-11	05	04	04		03	-13:-11
-16:-14	04	03	01			-16:-14
-19:-17	03	01			01	-19:-17
-22:-20	02					-22:-20
-25:-23	02					-25:-23
-28:-26	01					-28:-26

APPENDIX B

B-1. The Pre-Course Attitudes (Motivation) Scale.

B-2. Scoring Key for the Pre-Course Attitudes Scale.

APPENDIX B-1

THE PRE-COURSE ATTITUDES SCALE

Miami University is engaged in an extensive investigation of classroom instruction at the college level. One aspect of the over-all program concerns students' reactions to certain courses right at the beginning of the semester.

You have received a special answer sheet on which you are to mark all of your answers. Although you are required to identify yourself on the answer sheet, please be assured that your replies will have no bearing at all upon your grade in this course. The completed questionnaires will be analyzed by the staff of the Institutional Research Service. All replies will be treated with complete confidence.

Fill in the information called for at the top of the answer sheet now.

INSTRUCTIONS

The questionnaire consists of 57 statements of initial attitude toward the course. Read each statement and decide whether or not you agree with it. If the statement represents your own attitude, blacken the space between the dotted lines labeled A (agree) on the special answer sheet. If you disagree with the statement, fill in the D column on the special answer sheet.

Please consider every statement carefully and mark your reaction to each in either the A (agree) or D (disagree) column. Do not omit any of the items.

KEY:

Mark A if you agree with the statement.
Mark D if you disagree with the statement.

---

1. **I feel I will be wasting my time in this course.**
2. **I wish I could have avoided taking this course.**
3. **I would recommend that as many students as possible avoid taking this course.**
4. **Even if I have the chance in the future, I will avoid having anything to do with this subject.**
5. **I have no interest in this subject area.**
6. **I anticipate that this will be a dull course.**
7. **A large portion of the course will be just "dead wood."**
8. **I do not expect this course to help me broaden my outlook.**
9. **This course deals with impractical things.**
10. **I have heard that the professor does not make the material understandable.**
11. **This course will contribute very little to my fund of knowledge.**
12. **I have heard this professor cannot teach.**
13. **I feel this course does not fill a gap in my previous background.**
14. **This course will not tie in with the work I intend to do.**
15. **I have heard that this professor is not intellectually stimulating.**
16. **I have heard that this professor does not care whether or not his students learn the material.**
17. **I believe there will be too much emphasis on outside readings in this course.**
18. **I anticipate that I will do little in the way of original thinking about the subject matter of this course.**
19. **I have heard that this professor teaches over your head.**
20. **I expect this course to be too hard for me.**

(Go Right On To The Next Page)

KEY:

Mark A if you agree with the statement.
Mark D if you disagree with the statement.

---

21. I registered for this course mainly because my adviser told me to do so.

22. I have heard that this professor does not inspire his students.

23. I have heard that this professor does not relate the material to many other fields.

24. I expect this course to be too easy for me.

25. I expect this course to deal with detailed material.

26. This course is not in my major field of study.

27. I do not feel strongly one way or the other about being in this course.

28. I have heard that this professor does not take attendance.

29. I believe there will be little emphasis on outside readings in this course.

30. I anticipate that this course will deal little with theory.

31. I have heard that this professor is an easy grader.

32. I have had very little of the material presented in this course before.

33. I expect this course to deal with concepts and principles rather than facts.

34. I do not expect this course to be mainly a memory course.

35. This course will be concerned with practical, down to earth matters.

36. I have heard that this professor does not teach over your head.

37. This course will not duplicate material I have had before.

38. I feel I will not be wasting my time in this course.

39. I have heard that this professor knows his material well.

40. This course deals with practical things.

41. I have heard that this professor cares whether or not his students learn the material.

42. I heard that the professor makes the material interesting.

(Go Right On To The Next Page)

KEY:

Mark A if you agree with the statement.
Mark D if you disagree with the statement.

---

43. I am glad I am taking this course.

44. I can see how I could apply this course content in real life.

45. I anticipate that I will do a great deal in the way of original thinking about the subject matter of this course.

46. I have heard that this professor is intellectually stimulating.

47. This instructor has the reputation of being a good teacher.

48. I think I will forget less about this subject than about most other subjects.

49. I am in this course because I want to broaden my outlook.

50. This course deals with material about which I want to learn.

51. I have heard that this professor is a great inspiration to his students.

52. This class will be more stimulating than most of the others I have taken or will take.

53. I anticipate that this will be an exciting course.

54. This course will cover material which, for the most part, I consider to be vital and significant.

55. This course will help me realize my professional or vocational goal.

56. I believe I will enjoy this course more than any other I am taking this semester.

57. I believe I will learn more from this course than any other I am taking this semester.

****

APPENDIX B-2

Scoring Key

Weights are for statements with which respondent agrees. To "score" identify the median statement with which he agrees. The "score" is the weight for that response, interpolating when necessary. Disregard unweighted statements.

Statement Number	Weight for "Agree"	Statement Number	Weight for "Agree"	Statement Number	Weight for "Agree"
1	1.1	26	4.7	51	-
2	1.2	27	4.8	52	7.9
3	1.2	28	-	53	8.0
4	1.6	29	5.0	54	8.1
5	1.7	30	5.1	55	8.4
6	2.1	31	-	56	8.5
7	2.1	32	5.5	57	8.5
8	2.7	33	5.6		
9	2.7	34	5.8		
10	-	35	6.1		
11	2.7	36	-		
12	-	37	6.2		
13	3.1	38	6.3		
14	3.1	39	-		
15	-	40	6.5		
16	-	41	-		
17	3.4	42	-		
18	3.5	43	6.8		
19	-	44	6.9		
20	3.6	45	7.1		
21	3.8	46	-		
22	-	47	-		
23	-	48	7.4		
24	4.0	49	7.5		
25	4.6	50	7.5		